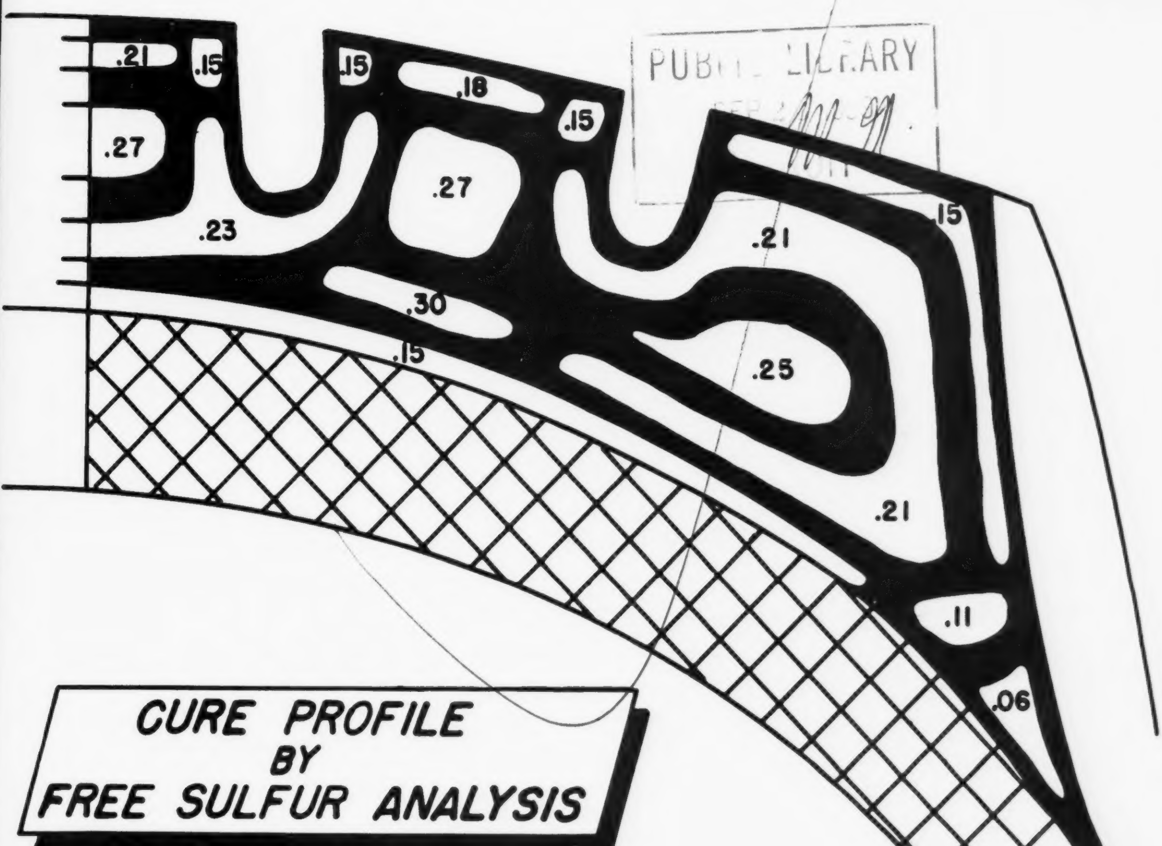
RUBBER WORLD

SERVING THE RUBBER INDUSTRY SINCE 1889



See page 865

SEPTEMBER, 1959

A BILL BROTHERS PUBLICATION

Influence of Order of Ingredient Addition at High Mixing Temperatures

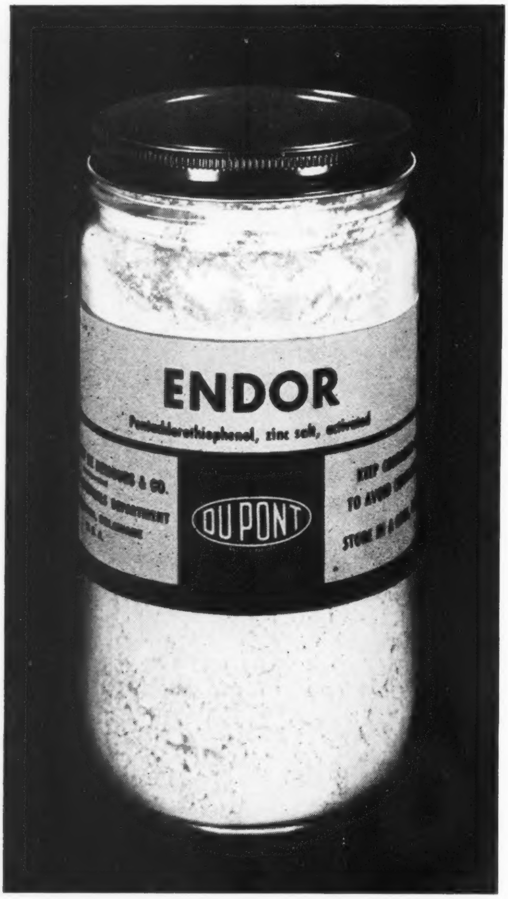
By H. C. Jones, N. J. Zinc Co.

page 857

From Du Pont

ENDOR

...a low-cost peptizer



ENDOR is an outstanding peptizer for natural rubber and an effective peptizer for the various SBR types.

ENDOR is a nontoxic, easy-to-handle gray powder that has no effect on the rate of cure or the final physical properties of the vulcanizate.

ENDOR can be effectively used to:

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- reduce power requirements
- produce greater uniformity in the compound

Other Du Pont peptizing agents are:

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RPA No. 3

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RR-10

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Better Things for Better Living . . . *through Chemistry*

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ARTICLE HIGHLIGHTS

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VOLUME 140, NUMBER 6 SEPTEMBER, 1959

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Cover photo: Courtesy of The B. F. Goodrich Co.

The opinions expressed by our contributors do not necessarily reflect those of our editors

FEATURE DEPARTMENTS


Service !


MUEHLSTEIN
CHEVROLET

NEWS of the

RUBBER WORLD

Rubber industry management and labor squared off against one another in hot and heavy lobbying that preceded approval by the House on August 13 of the Landrum-Griffith labor reform bill. The Rubber Manufacturers Association advised its management membership to contact their Congressmen urging support of this bill, while the United Rubber Workers had its locals do likewise in support of the Shelley bill.

Wage negotiations between the country's five largest rubber companies and the URWA began at various times between August 18 and September 1 on the union's demand for a general wage increase. Expiration dates of the 60-day reopening notices, at which time contracts may be canceled, range from September 1 to 17.

The natural rubber stockpile rotation program appears to be ended for fiscal 1960 by Congressional action that reduced funds for rotation and limited it to perishables other than rubber. After a six months' waiting period, about 40,000 tons of rubber will be sold before July 1, 1960, and this rubber will not be replaced.

Only one business regulation bill was passed, and many others were shelved in the first session of the so-called "liberal" 86th Congress. Those that failed to make the grade, however, will be heard from next year.

General Tire & Rubber Co. broke ground for a new $9.5-million tire plant in Mayfield, Ky.; Goodyear Tire & Rubber Co. plans construction of a $4.5-million tire plant in Alberta, Canada; U. S. Rubber Reclaiming Co. will construct a $1-million reclaim plant in Vicksburg, Miss.; Servus Rubber Co. is expanding its operations in Rock Island, Ill.

Mobay Chemical Co. reports that the markets for urethane foam cushioning materials have more than doubled in the past 12 months and that the 75-million-pound market for 1959 now seems assured. Goodyear has announced the availability of a castable urethane rubber called Neothane.

NEWS from ABROAD

DKG Section Meetings

Interesting topics were dealt with at two meetings of district sections of the Deutsche Kautschuk Gesellschaft, held last April, according to abstracts in *Kautschuk u. Gummi.*[1]

At the meeting of the Rhineland-Westphalia section on April 17, O. Rosenthal discussed the cold rubber, Buna Huls 150, produced by Bunawerke Huls. He explained that the difference between cold rubbers and Buna S3 and SBR 1000 was due to the difference in configuration and molecular weight. He brought out that in various tests, including practical road tests, Buna Huls 150 proved not only equal to two American cold rubbers, designated A and B, but even to be slightly superior in essential points.

On this occasion, also, H. Wunderloh spoke on mineral-oil plasticizers and oil extenders for rubber. These products are identified by density, the viscosity/density constant, and the refractivity intercept. Degradation of rubber, he showed, depends on the nature of the plasticizer: the paraffins have no effect on the rate of cure; naphthenes retard; while aromatics may retard or accelerate cure. The influence on mechanical values is directly related to the viscosity/density constant.

At the meeting of the South & Southwest German section, on April 18, F. Mocker reported on work in progress on polarographic determinations of accelerators, anti-agers, and other organic substances used by the rubber industry. In this method a solution is electrolyzed between two mercury electrodes, under increasing voltage. The presence of different substances causes increases in current at certain voltages. This decomposing or depolarizing voltage is characteristic for the quality; while the intensity of current indicates the quantity of the substance in the solution. MBT and 2-mercaptobenzimidazole could be quantitatively determined both in raw materials and in batches; MBT was also determined in vulcanizates. If ZnO is present in the compound the zinc salt must first be decomposed by pretreatment with acetic acid before the test can be made. The method is applicable also to complicated formulas, if MBT is the only accelerator; however, the limit of error increases to 5%.

Another paper, by W. Goyert, examined the swelling behavior of:

(A) Perbunan (NBR) reclaim mixed with increasing amounts of Buna S (SBR);

(B) Perbunan reclaim with increasing amounts of Perbunan;

(C) Buna S with increasing amounts of reclaimed butyl rubber; in iso-octane, iso-octane/toluene (70:30) and ASTM oil No. 3.

Curves indicated maximum swelling resistance of A with 10% Buna S; they flattened at 25% and dropped steeply at 50%. Curves for B paralleled those for A up to 25% Perbunan added, but continued a level course with increasing Perbunan. Hardness decreased for both A and B.

With increasing amounts of butyl reclaim, C showed increased resistance to swelling, and higher hardness, elongation, and tensile values. Small amounts of butyl reclaim in Buna S improved extrusion. It also appears that butyl reclaim added to PVC markedly improves swelling resistance without causing appreciable brittleness. No difference worth mentioning was found in the effect on swelling of the butyl reclaim, as compared with butyl rubber, so that its use is suggested in compounds where addition of butyl rubber is not possible.

[1] June, 1959, 168 WT.

Malaya Shows Output, Export Gains in 1959

Statistics of the Malayan rubber industry covering the first half of 1959 show that production, exports, and imports of natural rubber all increased, as against the first half of 1958. Output went to 325,982 tons, from 304,976 tons in the 1958 period, an increase of almost 7%, revealing that the Federation Government replanting scheme is beginning to show results. Rubber circles are already predicting that total production for all of 1959 may exceed the estimated 685,000 tons by a comfortable margin.

Total exports from Malaya during the first half of 1959, at 575,791 tons, were almost 10% higher than those for 1958, which had amounted to 523,282 tons. Considering that during the early half of this year Russia repeatedly figured as Malaya's best customer, it can hardly come as a surprise to find that she heads the list of buyers this year. Britain, which for years had ranked first, fell to third place, after the United States. China, last year a major purchaser of Malayan rubber, almost dropped out entirely earlier this year. It seems that China was thus showing her displeasure with Malaya for her pronounced anti-Communist stand and her action in closing the local branch of the Bank of China. Rubber men, however, are confident that she will reenter the Malayan rubber market since she is not getting enough rubber for her needs from other sources—Ceylon, Indonesia, Cambodia.

Comparative figures of shipments to the principal consumers of Malayan rubber during the first half of 1959 and 1958, are given below in tons:

	1959	1958
Russia	92,668	10,974
United States	81,996	56,451
Britain	72,991	110,731
Japan	58,410	50,523
Germany (West)	37,209	36,219
France	36,592	29,700
Italy	24,816	26,299
Poland	18,014	16,019
Australia	15,733	14,630
Canada	15,299	9,946
Argentina	12,610	17,500
China	6,000	40,200

Exports of liquid latex during the six-month period of 1959 rose to 61,227 tons from 56,756 tons, of which about 60% went to the United States (37,917 tons in 1959 and 32,202 tons in 1958.)

Imports of natural rubber into Malaya, chiefly from Indonesia as usual, came to 224,201 tons in the six months under review, an increase of about 12% against imports during the same period in 1958.

S.P. Rubber Gains Also

The growers of natural rubber in Malaya are finding to their great satisfaction that the Rubber Research Institute here, in developing Superior Processing Rubbers, may have hit upon a very good way of meeting synthetic rubber on its own ground in at least one field, that is as material for special extrusions.

Though work was started in this direction more than three years ago, no real progress was made until the end of 1956; the method, hitherto used only for pale crepe, was also applied to sheet. Whereas output of Superior Processing crepe has not exceeded 10 tons a quarter, Superior Processing sheet immediately found a far wider appeal; and in 1957, 220 tons were exported. This fact encouraged investigators to use the method for brown crepe, and in three months 70 tons

were bought by manufacturers willing to test it. Last year 1,149 tons of all types of S.P. Rubbers were exported, and in the first half of this year, the total went up to 984 tons.

Orders came from a number of countries including the United States, United Kingdom, New Zealand, Australia, Japan, Germany, Italy, South Africa, France, and Belgium, and it is worth noting that customers were prepared to pay the premium of four cents (S.S. currency) per pound. Efforts are being made to interest the Iron Curtain countries in the new rubber, and the Rubber Research Institute has put out a booklet in Chinese explaining the properties and advantages of S.P. Rubbers.

At present four firms in Malaya are producing S.P. grades.

French Rubber Industry Statistics

France imported 196,895 metric tons of rubber in 1958, official figures show. The amount included 67,165 tons of natural rubber from Viet Nam and Cambodia (but chiefly from Viet Nam) and 58,211 tons from Malaya, besides 55,749 tons (presumably synthetic) from North America.

The rubber manufacturing industry in France consumed 215,325 metric tons in 1958, against 214,856 metric tons in 1957, including natural and synthetic rubbers and latex and reclaimed rubber. The tire industry took 121,995 tons, against 115,800 tons the year before, of which 99,738, against 93,703 tons, went into tires for automobiles and motorcycles; 6,538, against 6,616 tons, into cycle tires, and 5,690, against 5,078 tons, for retreading materials.

Other rubber manufactures accounted for 93,329.6, against 99,055.6 tons; the difference was mainly due to decreasing off-take in 1958 for rubberized fabrics (2,089.5, against 2,858.5 tons), footwear (10,040, against 11,956.7 tons); heels and soles (6,553.4, against 8,493.8 tons), and crepe soles, 2,118, against 4,411 tons. Consumption for sponge rubber went up slightly from 11,925 tons in 1957 to 12,422.5 tons last year. Most other articles showed comparatively small differences either way.

Exports of pneumatic tires from France rose from 41,861 metric tons in 1957 to 54,879 tons in 1958; at the same time imports fell from 9,007 tons to 8,500 tons.

Pelletized News

B. F. GOODRICH CHEMICAL CO. has disclosed plans for construction of a $4.5 million plant in Australia to make Geon vinyl plastic materials. It will be built in cooperation with Australian interests. The basic raw materials for the facility will come from Australian sources. Geon serves as the basic material for many consumer products in such industrial applications as pipe, electrical insulation, ductwork, sponge, structural parts, and specialty coatings.

A liaison office to protect the interest of the rubber industries of the countries of the European Economic Community was formed in Milan, January 16, 1959, by representatives of the rubber associations of Italy, Belgium, Netherlands, France, and Germany. To be known as the Bureau de Liaison des Industries du Caoutchouc de la Communaute Economique Europeenne (B.L.I.C.), it will have headquarters temporarily at Brussels, Belgium. The president for 1959, chosen by lot, is Friedrich-Wilhelm Kaiser, Germany, and the vice president is Emilio Solcia, Italy.

THE RUBBER RESEARCH INSTITUTE OF MALAYA reports that wind damage is a serious threat to certain high-yielding rubber trees. In an article in the Institute's organ, *Planters' Bulletin*,[1] the investigators state that in some instances wind has caused "catastrophic loss of entire replantings." Since the greater part of the more elevated Malayan coastal areas, both east and west, are very windy, rubber estates in the Malacca, Negri Sembilan, and Selangor districts have abandoned use of several of the most promising new superior clones including the very high-yielding RRIM 613.

[1] July, 1959, p. 79.

A 75-acre site in Amiens, near Paris, has been selected for construction of Goodyear Tire & Rubber Co.'s new tire and tube manufacturing plant in France.[1] Passenger, truck, and farm tires for replacement and original equipment will be produced for France and the common European market, and for export. Heading the operations in France as managing director is James A. Goodson, former managing director of the company's West German operations. Production director will be W. T. Clayton, a past manager of Goodyear's plant in Sweden and more recently manager of European production. E. J. Weller, former chief engineer at Goodyear-Colombia, is chief engineer of the new plant, and Jack L. Woodliff, former personnel manager at Goodyear-Philippines, is personnel manager. The company is the first American rubber manufacturer to build a plant in France.

[1] See RUBBER WORLD, Aug., 1959, p. 644.

SOCIETE INTERNATIONALE PIRELLI S.A., Basle, Switzerland, and a group of private investors in Turkey have received permission from the Turkish government to build the first tire plant in Turkey. A corporation has been formed with a capital of 45 million Turkish lire ($5 million), and production is scheduled to begin in 1960. Initial output will be 120,000 passenger and truck tires per year and is expected to be increased to 250,000 tires annually within a short time, according to Pirelli.

A Japanese trade delegation to Malaya and Malayan officials have conducted exploratory talks on a trade agreement between Japan and Malaya. Object of the agreement is to increase the export of iron ore, rubber, and tin to Japan, with imports of fabrics, iron and steel, cement, industrial machinery, and food products correspondingly raised by Malaya. The Japanese Rubber Importers' Association predicts that Japan will import 140,000 tons of natural rubber, 10,000 tons of latex, and 10-15,000 tons of synthetic rubber annually. For the last two years the annual rate of rubber shipments from Malaya to Japan has been 100,000 tons.

INTIRUB (Indonesia Tire & Rubber Works), a joint Indonesian-Czechoslovakian venture, has just started the production of tires. The factory, equipped by the Techno-Export company of Praha, Czechoslovakia, reportedly can manufacture about 1,000 tires a day, which appears to be 75% of present capacity. Eventually output is expected to reach 500,000 tires annually.

Rubber accounted for 64% of South Viet Nam's total exports last year. While rubber's share in the country's foreign trade reportedly showed a volume drop of 11%, the actual amount, at 67,500 tons, represented a substantial increase over the 1957 rubber totals of 47,625 tons. France, as usual, was the best customer, taking 80.5% of the 1958 shipments; the United States and Britain came next.

GOODYEAR tires are to be manufactured in Italy under an agreement between the CEAT company of Turin and the American concern, it is learned. Production, chiefly of truck tires, is to start this year.

MALAYAN CABLES, LTD., Kuala Lumpur, has been formed to manufacture cables in Petaling Java. One-fifth of the authorized capital of 5,000,000 dollars (Straits) will be subscribed by Malayan interests, while the rest will come from several internationally known cable companies.

Photo courtesy Lehigh Safety Shoe Company, Emmaus, Pa.

A sole improvement with a four-fold return

Four times longer life! That was the return on a single improvement made in the safety shoes pictured above—as proved in actual wear tests at a big metal-working plant.

What made the difference was a new kind of sole. It's made of a blend of CHEMIGUM, the truly oil-resistant rubber, and PLIOFLEX, the light-colored styrene rubber. The end result is outstanding resistance to the cutting oils, metal turnings and sharp grating that so quickly took the toll of the other test shoes.

Other advantages of the new sole include an attractive, light color, a very comfortable resistance to flexing and abrasion. Equally important are the facts that the CHEMIGUM blend is easy to process and can be adjusted to meet any need for oil resistance at minimum cost.

If you're looking for an improvement in any rubber product, why not look into blends of CHEMIGUM and PLIOFLEX. Full details and technical service are yours by writing to:

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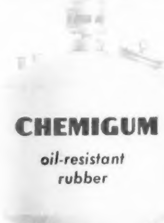
Akron 16, Ohio



GOODYEAR

CHEMICAL DIVISION

Chemigum, Pliofle×—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

News from Abroad

LANDA SHOE CO. (Firma Naessens), Kruishoutem, Belgium, will shortly begin production of workshoes vulcanized by Process 82, the patented system licensed by Ro-Search, Inc., Waynesville, N. C., U.S.A. The owners of Landa Shoe, Mr. and Mrs. Naessens, recently visited Ro-Search to complete arrangements for the necessary equipment to be supplied by the latter company. They also visited Georgia Shoe Co.'s Baxter, Tenn., plant to observe that firm's production set-up on Process 82 footwear.

A. W. Lotz, formerly production manager, has been appointed plantations manager, Firestone Plantations Co. in Liberia. He will be in charge of all plantation operations at the company's Harbel and Cavalla plantations, reporting to **A. G. Lund. G. P. Spangler,** former estates manager, succeeds Lotz as production manager. He will have charge of the estates and factory departments and all matters pertaining to the Cavalla plantations. **A. H. Black,** senior plantations supervisor, succeeds Spangler as estate manager and will be responsible for all estates operations including planting, maintenance, tapping, and the collection of the rubber and latex.

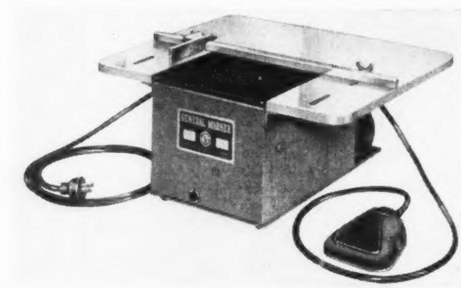
ELASTO PRODUCTS, Bentota, Ceylon, recently signed a license agreement with Ro-Search, Inc., Waynesville, N. C., U.S.A. for the exclusive rights to the Process 82 leather footwear vulcanizing system for Ceylon. Donald Gunasekera, director of Elasto Products, came to the United States during July to discuss final arrangements and visit Ro-Search licensees. Elasto, affiliated with Ro-Search for eight years, now makes sponge sole and canvas footwear in its factory which is situated in the jungle.

Andrew C. Wenzel has been named managing director of the Firestone Tyre & Rubber Co., Ltd., of England, effective August 1. He succeeds **William E. Duck,** who will remain as chairman until retirement late this year. **George L. Anderson** succeeds Wenzel as managing director of Firestone-India. Wenzel in his new post will control production and distribution of Firestone products in Great Britain, with headquarters in Brentford, England.

HARRISONS & CROSFIELD, LTD., has appointed the first Malayan director of a rubber company. Raja Musa bin Raja Mahadi, deputy speaker of the former Federal Legislative Council, has been named director of the Sungei Bagan Rubber Co., which operates a 3,000-acre estate. He is the fourth Asian director appointed by this agency in the last 11 years.

(Continued on page 934)

NEW EQUIPMENT



Production-line marker

New General Marker

General Research & Supply Co., Grand Rapids, Mich., has introduced a new, low-cost, production-line marker that prints trade marks, designs, patent numbers, part numbers, instructions, or other markings on such materials as plastics, leather, rubber, fiberboard, fabrics, wood, metal, glass, or paper. The marker is said to print all designs including fine type clearly and cleanly at production-line speeds. Unit prints by the silk screen process and runs at a speed of 5,000 cycles per hour. Intermittent operation permits worker to set his own pace, marking from one piece to 5,000 pieces per hour.

The printing mechanism is housed entirely below the table surface of the marker. Unit can be used on top of work bench and equipped with automatic tabletop pressure switch for handling smaller parts or assemblies. Registering table, which is an integral part of the marker, has accurate registering guides and is slotted for attachment of jigs or fixtures. Also, for marking larger objects, the unit can be installed flush in work table.

Other features of the marker include: rugged, precision construction for extreme durability; completely enclosed ink fountain; quick change screens that permit switching of designs in seconds; and extreme versatility of the screen process in the type of materials it can print and the special printing mediums it can handle. Special automatic feed mechanisms are available for specialized applications.

Complete information, prices, and details are available from the manufacturer.

Micro Hardness Testers

Model H5 Wallace dead load micro-hardness tester for rubber, rubber-like materials, and plastics, available from Testing Machines, Inc., Mineola, L. I., N. Y., eliminates the need of molding standard-size test specimens and permits the hardness of small parts, sheets, and irregular shapes to be measured directly.

The depth of indentation is measured electronically. The basic machine consists of an indentor and a means of applying a minor and then a major load. For O-rings, small pieces or seals, and irregularly shaped parts, this device provides a means of test not obtainable by other methods.

It gives accurate readings on specimens less than ½-millimeter (0.01969-inch). This feature is valuable where only a very thin layer may be available, such as oil seal.

The unit can measure the hardness or softness of insulating

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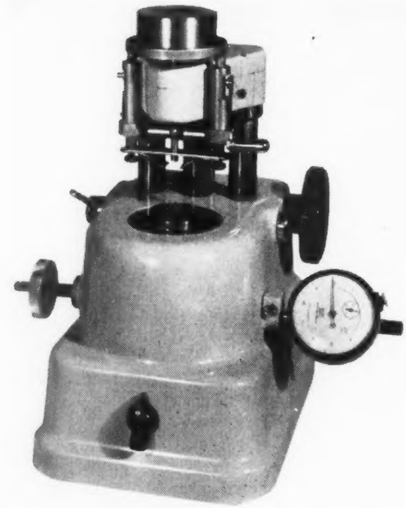

TMI micro-hardness tester

materials on electric wire without stripping the wire or molding a specimen. By taking a series of readings at convenient time intervals it is possible to plot a graph relating indentation and recovery to time.

Model H6 is available for rigid plastics and for measuring the state of cure of synthetic resins and fiber reinforced materials. Model H7 is available for micro-hardness measurement of extremely thin surface coatings. It will measure difference of indentation on films as thin as 0.0005-inch and show variations in hardness occurring over the surface of a single specimen.

The instrument is robust and requires no servicing, according to the company. Its electronic components are in a self-contained unit in the base.

Additional information is available from the company.

Conveyorized Slab Cutter

A new conveyorized Slab Cutter, 20 feet long and 80 inches wide, is available from The Falls Engineering & Machine Co., Cuyahoga Falls, O. It was demonstrated recently to representatives of companies fabricating urethane stock.

Femco's new machine takes big, untrimmed blocks and long slabs of urethane foam now being manufactured in bulk and automatically levels and splits the blocks into thin sheets and converts the long slabs into roll stock as thin as ⅛-inch.

The huge blocks can be split into three- and four-inch thickness without a "flip up" at the end of the cut. A power-driven input compression roll with a variable-speed adjustment and

(Continued on page 852)

Femco's Conveyorized Slab Cutter

MONSANTO RUBBER CHEMICALS
ANSWER ANOTHER
IMPORTANT COMPOUNDING

QUESTION:

What economical vulcanizing agent can give my stocks highest heat resistance and more safety from scorch with no bloom or discoloration?

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SULFASAN R dithioamine vulcanizing agent

You can get the best heat resistance at a reasonable cost *and* eliminate bloom in your finished compounds by partial replacement of conventional curing agents with SULFASAN R. At the same time, this unique vulcanizing agent provides greater safety from scorch and can also boost modulus lower compression set and improve aging.

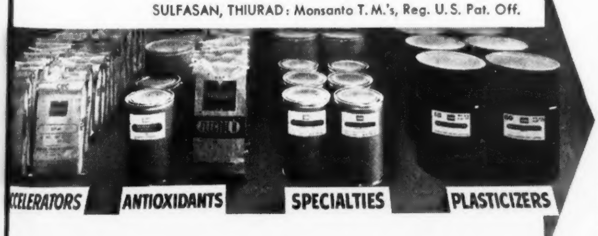
Economical SULFASAN R trims the cost of some compounds by reducing the total amount of vulcanizing agent required. As little as 0.8 to 2 parts of SULFASAN R per hundred of rubber, plus a small amount of THIURAD (tetramethylthiuram disulfide) or a similar curing agent, is usually sufficient to achieve good results in GR-S, butyl, nitrile and natural rubbers. For more information, use the convenient coupon.

HEAT RESISTANCE

COMPOUNDS	**A**	**B**
Nitrile Rubber	100	100
Zinc Oxide	5	5
Stearic Acid	1	1
FEF Black	40	40
THIURAD	3.50	0.80
SULFASAN R	—	0.80
CURING AGENT COST	$3.99	$2.15
RESULTS		
Mooney Scorch (Mins.), Large Rotor @ 250° F.	12.5	31
Compression Set 70 Hrs./100° C.	27%	24%
Blooming	1 day	None in 9 months
Unaged		
Tensile, psi	2480	2520
Elongation, %	530	500
Hardness	64	65
Aged 70 Hrs./300° F.		
Tensile, psi	600	780
Elongation, %	20	30
Hardness	85	87

See how a lower-cost SULFASAN R/THIURAD curing system compares with THIURAD alone in a heat-resistant nitrile rubber compound.

SULFASAN, THIURAD: Monsanto T. M.'s, Reg. U. S. Pat. Off.



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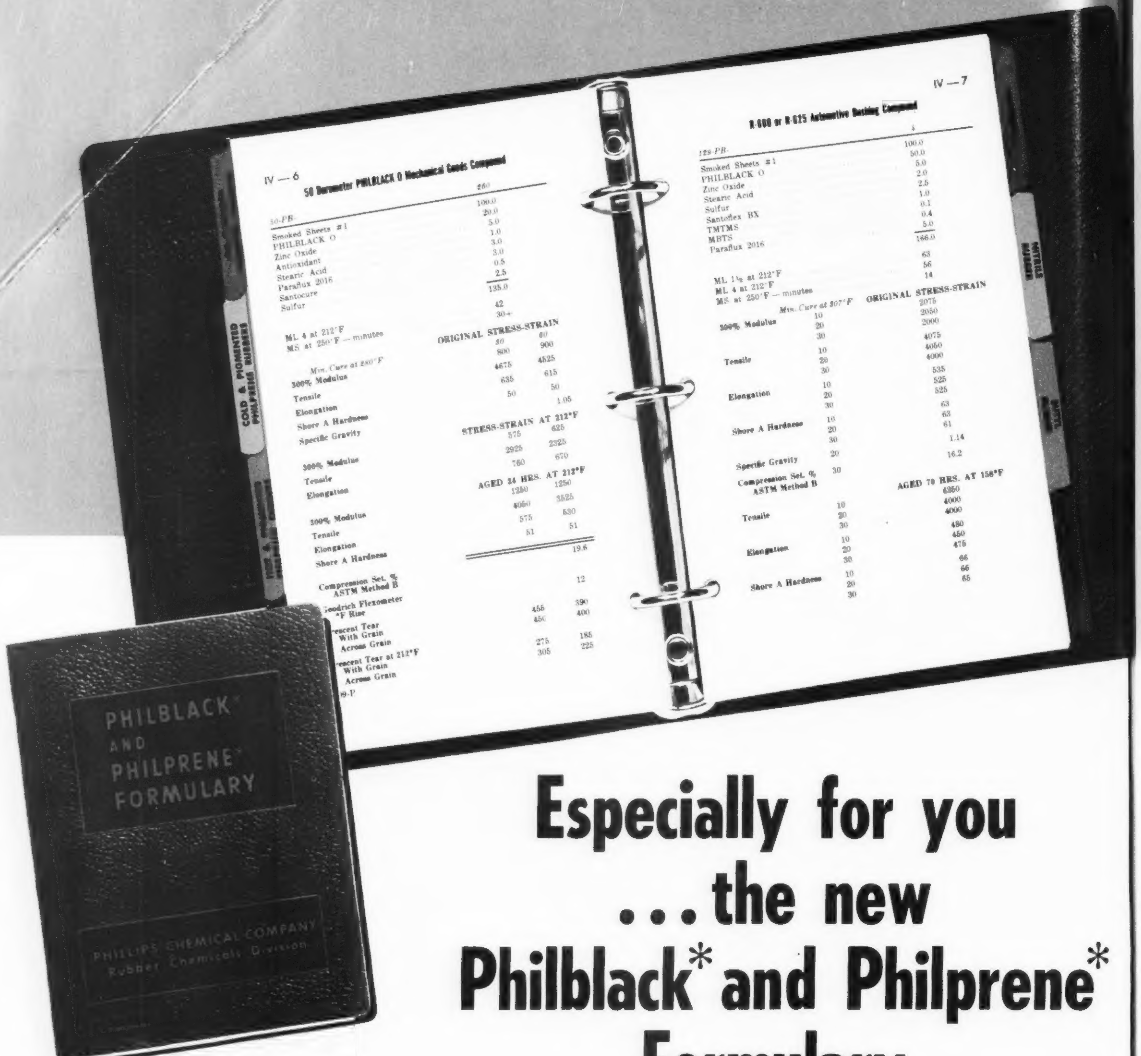
PHILLIPS 66



Especially for you ...the new Philblack* and Philprene* Formulary

Phillips Chemical Company has compiled a comprehensive ... *and invaluable* ... handbook for rubber compounders and manufacturers of various rubber products.

This important book contains detailed and workable recipes with emphasis on the development of easy processing stocks. And each compound is evaluated according to its rating on various standard tests ... Modulus, Tensile, Elongation, Shore A Hardness, Compression Set.

This valuable information (the result of years of experience plus thousands of hours of testing and research in our modern laboratories) is *boiled down* to simple, practical formulas and indexed for easy reference.

Your Phillips technical representative will be glad to give you a copy of this valuable book. It can help you to make better rubber products ... more easily and more profitably.

PHILLIPS CHEMICAL COMPANY

Rubber Chemicals Division, 318 Water St., Akron 8, Ohio

District Offices: Chicago, Dallas, Providence and Trenton

West Coast: Harwick Standard Chemical Company, Los Angeles, California

Export Sales: 80 Broadway, New York 5, N. Y. European Office: Limmatquai 70, Zurich, Switzerland

PHILLIPS 66

*Trademarks

NEW MATERIALS

Pennox A, B, C, D Antioxidants

Four new Pennox antioxidants have been announced by the industrial chemicals division, Pennsalt Chemicals Corp., Philadelphia, Pa. Designated Pennox A, Pennox B, Pennox C, and Pennox D, the new antioxidants will protect light and dark stocks, raw *Hevea* and SBR polymers and their vulcanizates, and latex products from the deteriorating effects of oxidizers, heat, and light. The following brief qualitative descriptions indicate the general areas of application for each of the new materials.

Pennox A is an excellent general-purpose alkylated amine antioxidant. It is an effective age resister for both dry rubber and latex products, although its slight discoloring effect may limit its use in light-colored stocks.

Pennox B is a good non-staining, non-discoloring antioxidant for *Hevea* and SBR vulcanizates and raw SBR polymer, also reports the manufacturer.

Pennox C provides good protection to *Hevea* and SBR vulcanizates. It is especially recommended for latex products because it shows exceptional resistance to discoloration on exposure to sunlight.

Pennox D will provide good non-staining and non-discoloring antioxidant activity in dry *Hevea* and SBR vulcanizates and latex films. It can also be used in latex foam goods although it is not so effective in this application as either Pennox A or Pennox C.

Some typical physical properties of these Pennox antioxidants have been reported as follows:

	Pennox A	Pennox B	Pennox C	Pennox D
Composition...	alkylated diphenyl-amine	hindered bisphenol	hindered bisphenol	hindered bisphenol
Color.........	brown to dark brown	brown to dark brown	light amber to amber	amber to brown
Consistency....	moderately viscous	slightly viscous	moderately viscous	moderately viscous
Storage stability.......	good	good	good	good
Sp. gr. @ 25°/25° C....	0.98	0.98	0.93	0.92
Ave. wt. per gal.	8.1 lb.	8.2 lb.	7.7 lb.	7.7 lb.

In general, it is recommended that all Pennox antioxidants be used at 1.0 phr. in both dry rubber and latex compounds. For latex compounding, Pennox A, C, and D are readily emulsified and compatible with most latex compounds. The antioxidant emulsion is added to the latex at 1.0 phr. on a dry basis. For film goods Pennox can be added as the last component of the compound. For foam products the Pennox is added before frothing.

For detailed information on the Pennox series two technical bulletins, "S-151—Pennox Antioxidants for Rubber Compounding" and "S-152—Pennox Antioxidants for Latex," are available from the company.

Neothane Polyurethane Rubber

Neothane, a castable polyurethane rubber, is now available from The Goodyear Tire & Rubber Co., Akron, O., for practical applications in areas that heretofore were beyond the ability of rubber products.

In the pure gum form, Neothane is harder than most conventional reinforced rubber compounds, has two to four times

New Materials

the strength of these compounds, and can outperform metals in applications requiring the combined properties of toughness, resilience, and abrasion resistance, it is claimed.

The new rubber compound can be cast into shapes that would be impractical for other elastomers. It is liquid during manufacture and has few limitations on shapes, irregular contours, or fine details. Curing temperatures are low, compared to those for normal rubber compounds.

Neothane is made in two basic types: a "Standard" Neothane with a high-friction surface, and a "Lubricated" Neothane with low friction characteristics. Each type can be designated for specific Shore A hardness to fit product needs.

Neothane has excellent resistance to hydrocarbon solvents, oils, and grease. At normal temperatures, water and moisture vapor have no effect on the new rubber. It is not recommended for wet or moist air service above 180° F. or in the presence of oxygenated solvents, acids and alkalies.

Neothane compounds are rated for working temperatures of 200-225° F. in normally dry air, or in the presence of lube oils and grease. Occasional exposure at higher temperatures, up to 300° F., can be tolerated for short periods. Low temperatures, down to —40° F., are within the working range of Neothane.

Some typical physical properties of Lubricated Neothane are reported as follows:

300% Modulus, psi	2,000
Ultimate tensile, psi	3,600
Elongation, %	500
Shore A hardness	85
Compression set (Method B), %	15
B of S abrasion index	over 7,000

An eight-page brochure, S-5125, giving detailed information on Neothane, is available from the company.

RTV-120, RTV-160 Silicone Rubbers

Two new RTV (room-temperature vulcanizing) silicone rubbers are available from the silicone products department, General Electric Co., Waterford, N. Y. Identified as RTV-120 and RTV-160, both are compounds that will cure at room temperature in a few minutes to form resilient silicone rubber sponge for such applications as void filling, cushioning, and vibration damping.

As a result of their curing system, RTV-120 and RTV-160 will meet the many applications which need the properties of a silicone sponge, but cannot use conventional silicone sponge compounds owing to their longer and higher temperature curing characteristics.

The new rubbers provide excellent resistance to temperature extremes, weather, ozone, and sunlight and are particularly suitable for a number of military and electronic applications, it is claimed. RTV-160 is designed for applications requiring somewhat greater resiliency than offered by RTV-120. Pot life and sponge properties of each compound, however, may be varied to meet the particular application. Smaller pore size, accompanied by reduced pot life, can be obtained by increasing the amount of curing agent (Silicure T-773).

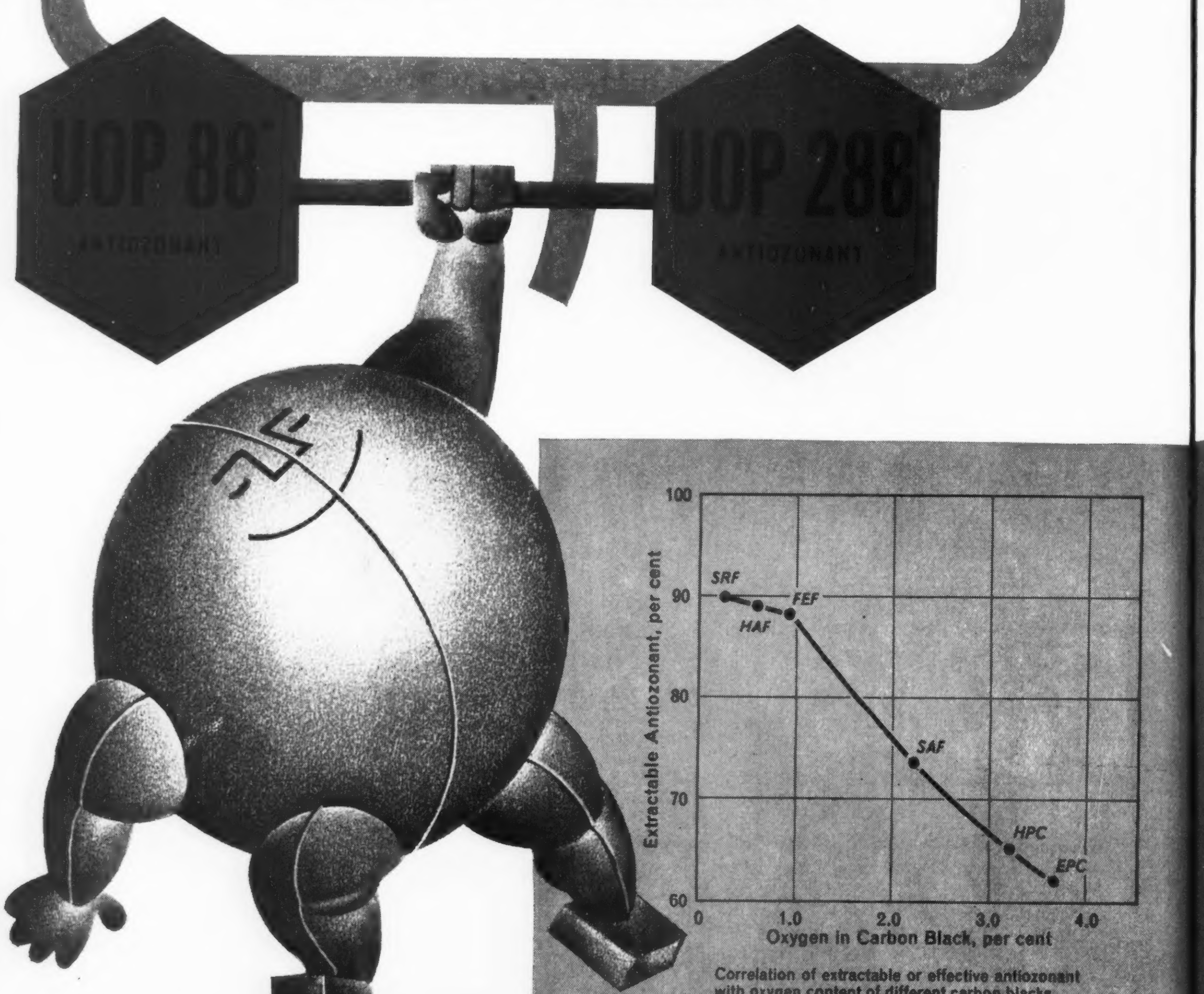
Some typical properties of sponge made with RTV-120 and RTV-160 are reported as follows:

	RTV-120	RTV-160
Specific gravity	0.5–0.7	0.6–0.8
Pounds per cubic foot	31–44	37–50
Cell structure	closed	closed
Surface	thin skin	thin skin
Compression-deflection, psi., 25% compression	28	31
Resiliency (Bayshore)	60–70	65–75
Weight loss, 24 hrs./80° F.	1.9%	1.6%

Formulation, mixing instructions, and other information are presented in a bulletin, "RTV Sponge," available from G-E.

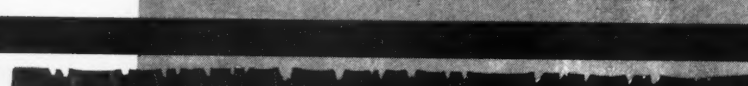

NEW!

what type of CARBON BLACK helps fight ozone attack?

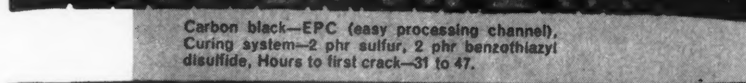


Correlation of extractable or effective antiozonant with oxygen content of different carbon blacks.

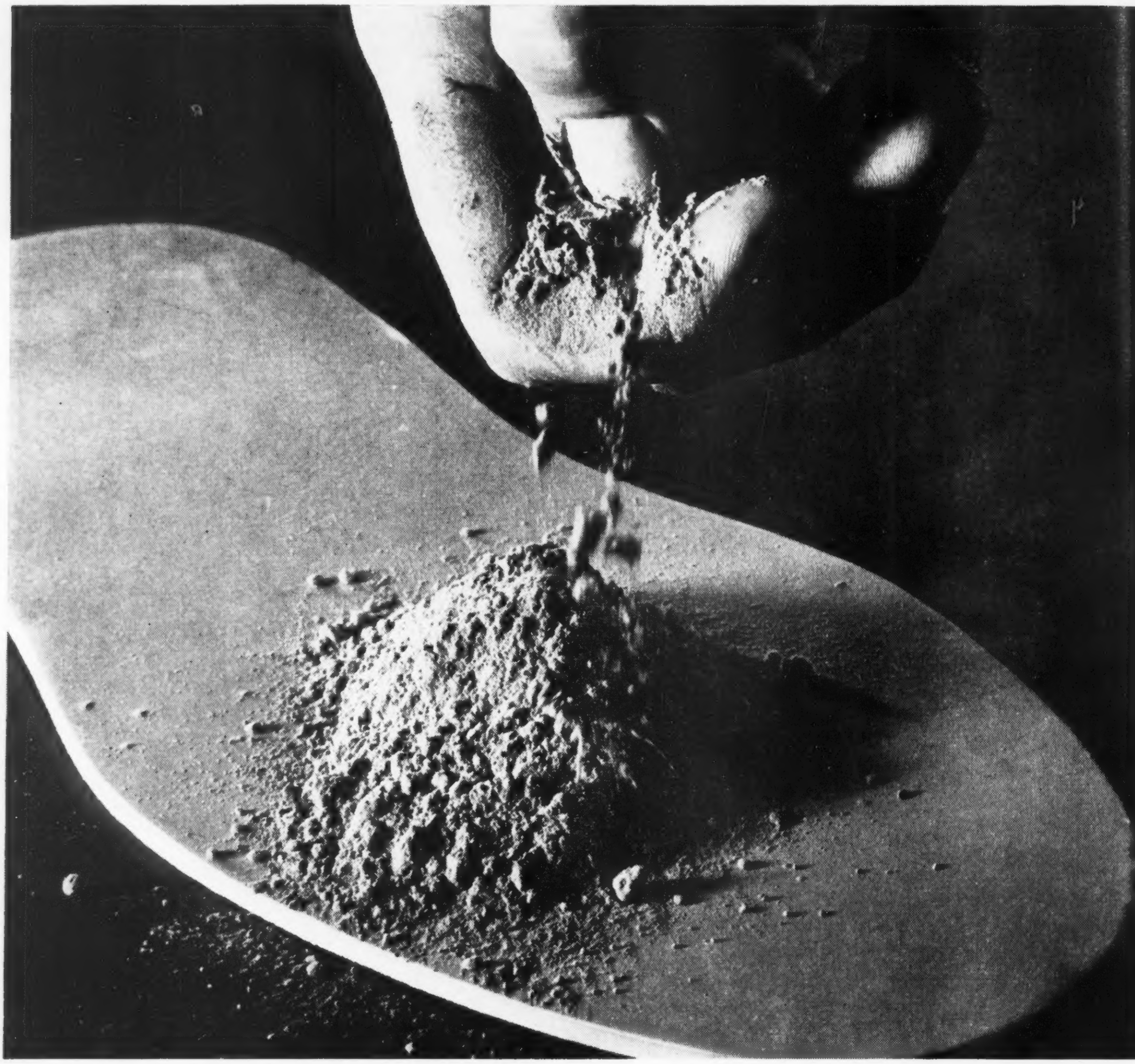
The SBR specimens at right were exposed to ozone at 100° F, 20 percent elongation, 52 hr. at 33 pphm ozone, then 187 hr. at 63 pphm ozone.



Carbon black—EPC (easy processing channel), Curing system—2 phr sulfur, 2 phr benzothiazyl disulfide, Hours to first crack—31 to 47.



Carbon black—HAF (high abrasion furnace), Curing system—2 phr sulfur, 2 phr benzothiazyl disulfide, No cracks in 239 hr.



What happens when you

add a pinch of permanence?

When you're trying to give a shoe-sole compound more of the qualities you want it to have, don't forget this powdered resin.

A little of it, in an SBR compound, can increase the hardness and boardiness.

A little more—on the order of 20 parts to 100 of elastomer (with some nitrile as a common flux)—can further improve hardness and stiffness, as well as resistance to abrasion and heat distortion.

It reduces tensile strength *less* than a thermoplastic resin would. Because it is heat-setting, the properties it brings to the stock stay there through higher temperatures—as high as 250°F.

You get more durability—more permanence—than with other types of resins. You pay less for it.

This is just one of 33 Durez resins helping compounders make better rubber products. Some of these resins harden and reinforce nitrile rubber. Others add permanence traits to natural rubber and Neoprene. Still others strengthen the grip of solvent-type adhesives, or bond nitrile rubber to metal during molding.

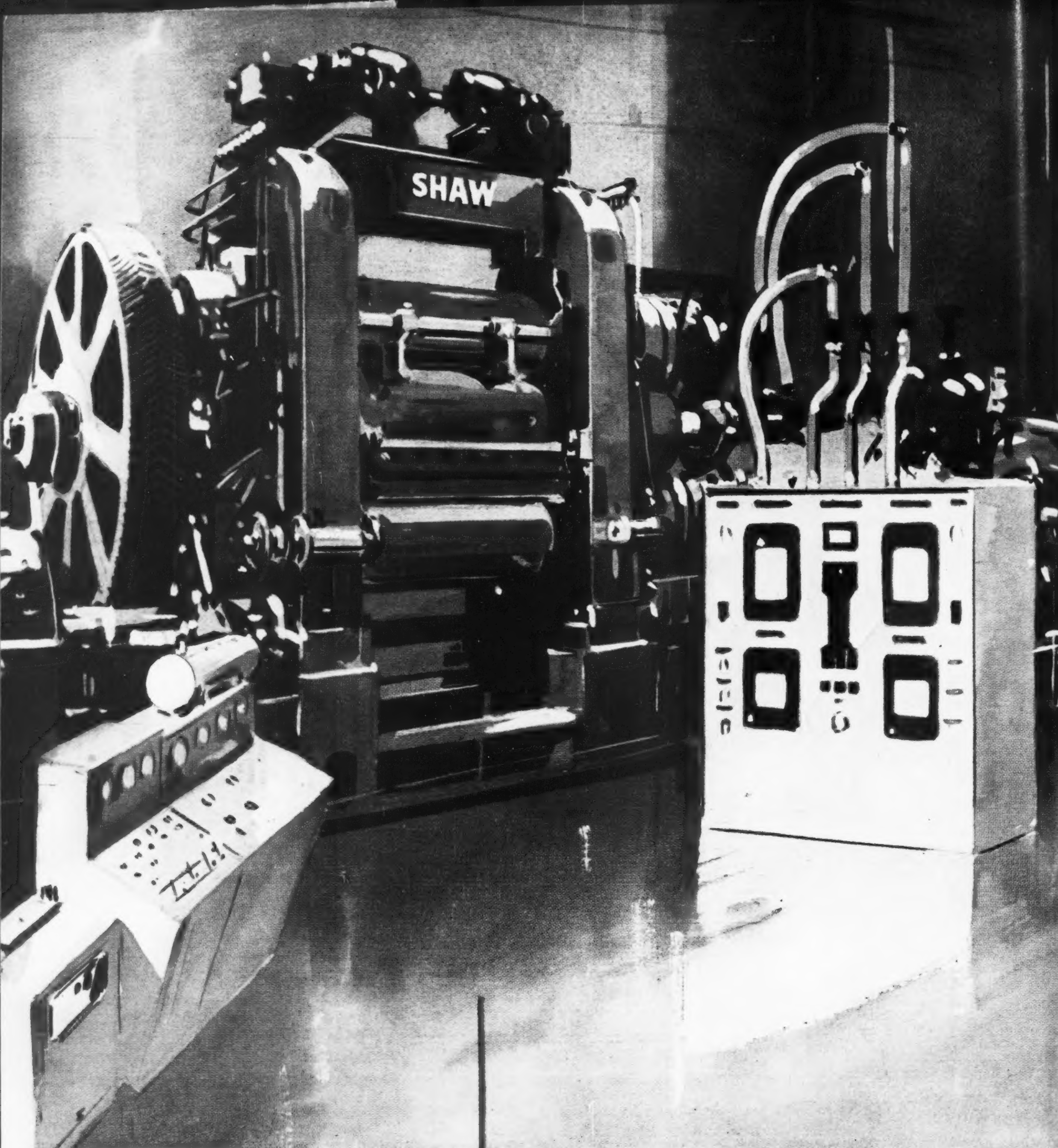
To meet your processing conditions, you can get these resins in powder, lump, liquid, and emulsion forms. If you'd like to know more about them, write for the illustrated bulletin, "Durez Resins in the Rubber Industry."

DUREZ PLASTICS DIVISION

209 WALCK ROAD, NORTH TONAWANDA, N. Y.

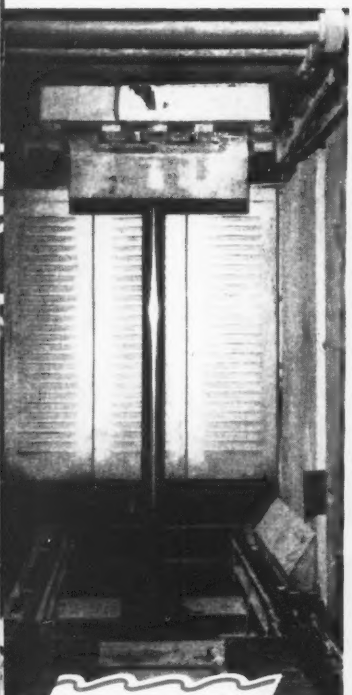
HOOKER CHEMICAL CORPORATION

HOOKER CHEMICALS PLASTICS


SHAW

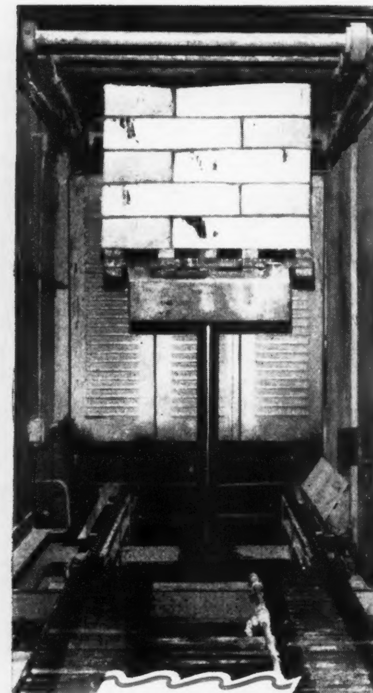
SYNTHETIC BAYTOWN RUBBER

...FIRST...*and only*



EVERY

BALE



SETS

Every time a newly made bale of Baytown Masterbatch is positioned by this pallet-loading machine . . . every time a pallet is shifted to shipping or to a warehouse . . . a new production record is made.

For United's Baytown plant has manufactured nearly TWO BILLION POUNDS of synthetic rubber masterbatch — more than any other producer!

Out of this vast experience has come a reputation for quality and uniformity . . . for production and shipping efficiency . . . for technical proficiency.

Specify BAYTOWN MASTERBATCHES for excellence!

SYNTHETIC BAYTOWN RUBBER

Rubbers of Science

NEW PRODUCTS

Flexiprene Industrial Gloves

Neoprene-coated industrial gloves with improved flexibility and comfort characteristics have been developed by Hood Rubber Products, a division of The B. F. Goodrich Co., Watertown, Mass. The improved characteristics of the oil-resistant gloves are attributed to a process in which a knitted jersey shell or liner is coated with neoprene. Conventional neoprene-coated gloves are made with less-elastic, woven flannel.

The new glove, called Flexiprene, is being marketed under the company's Hood Brand. The gloves are said to reduce hand fatigue because they require less effort to bend the fingers than do other neoprene-coated gloves.

The knitted construction makes it possible to have the seams on the side of the fingers; whereas others have them on the working surface.

Neoprene-coated gloves are used extensively in the food, dairy, and fishing industries, in chemical and petroleum processing plants, and for handling corrosive and oily materials.

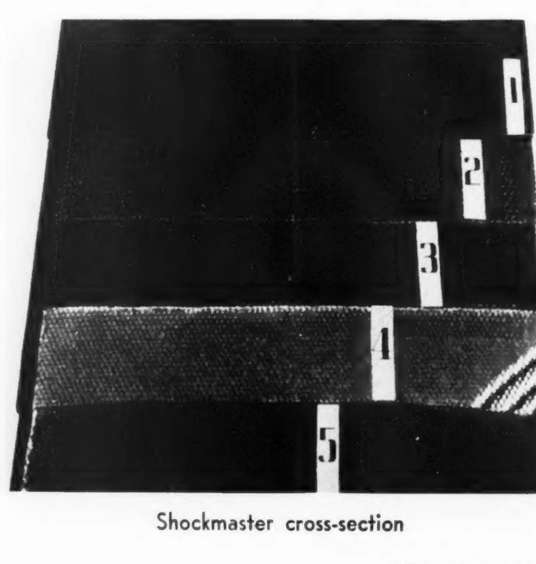
Flexiprene gloves are available in three sizes: the wrister, with a green knit wrist; a 12-inch gauntlet; and 14½-inch gauntlet.

Quaker Shockmaster Belt

Quaker Rubber Division, H. K. Porter Co., Inc., has developed a unique type of conveyor belt construction, called the Shockmaster for its ability to absorb and distribute shock. A medium-weight, double-duty belt extremely flexible with a high impact resistance for use over smaller than usual pulleys on short center hauls, it was specifically designed to allow the belt to be turned over after the first carrying side is no longer satisfactory.

The Shockmaster is made of two- or three-ply heavy-duty cotton nylon fabric with skim coat between plies as a core. Entirely encompassing this core is an envelope ply of frictioned and double-skimmed extra-heavy open-weave all-nylon fabric.

(Continued on page 834)



Shockmaster cross-section

Water Wash: Mobilplex EP clings to surfaces even under direct water washing; also resists mild acids, metal-working emulsions.

Heat: Mobilplex EP holds consistency, resists runout at temperatures in the range of 300 F. Can be pumped at sub-zero temperature, has low shear resistance.

Extreme-Pressure: Mobilplex EP has shown excellent results in Timken OK-Load, 4-Ball Wear and similar tests. It has unusual capacity to withstand severe shock loads as evidenced by outstanding performance in heavy-duty equipment.

LABORATORY TEST SUMMARY RESULTS
MOBILPLEX EP (M) and 5 Leading Competitive EP Greases (A,B,C,D,E)

PROPERTY EVALUATED	RATING			
	Excellent	*Good*	*Fair*	*Poor*
Heat Resistance	M	A	C,D,E	B
Service Performance	M	A,C,E	B,D	
Extreme Pressure	M,A,C	B,D,E		
Anti-Wear	M,A	B,C	D,E	
Rust Protection		M,B,C, D,E		A
Water Resistance		M,B,C	A,D,E	
Handling Properties		M,A,B C,D,E		
Controlled Bleeding		M,A,C	B,D,E	
Non-staining		M	A,B, D,E	C

New Products

(Continued from page 830)

The double skim is placed inside to cushion it to the core. Top and bottom covers are $\frac{3}{32}$- by $\frac{3}{32}$-inch. This feature will enable the customer to turn the belt over. Covers are 2,500 to 3,000 psi. minimum tensile.

The unique construction is said to give the belt unusual flexibility without loss of bulk or strength. Also, the belt is designed to distribute load shock over a greater area of the belt. The cushion gives the open-weave fabric a chance to work and still return to its original position.

Handling of lump-size material up to five and six inches is recommended for the Shockmaster. Breaker strip is not needed in this belting, according to the firm. The belting is to be known as four-ply rating or five-ply rating belt. Gage on four-ply rating is $\frac{7}{16}$-inch and on five-ply rating, $\frac{1}{2}$-inch. The belting may be used to handle requirements of 130 to 140 pounds per inch of belt in four-ply rating. At five-ply rating, the belting will answer to 175 to 185 pounds per inch of belt. Both are available in 18-, 24-, and 30-inch widths.

In the accompanying photograph of the Shockmaster, the sections are as follow: (1) top cover of abrasion-resistant SBR rubber; (2) envelope ply of extra-heavy open-weave all-nylon fabric; (3) double-gage skim coat of rubber; (4) three-ply heavy cotton-nylon carcass with a skim coat of rubber between plies, and (5) other half of skim coat extra open-weave all-nylon envelope.

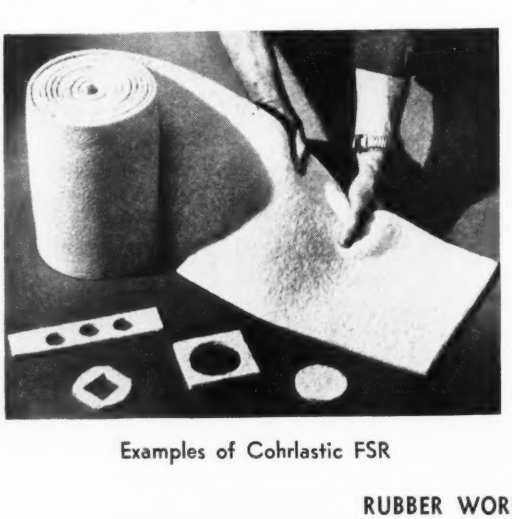
New Cohrlastic FSR

The Connecticut Hard Rubber Co., New Haven, Conn., has developed a new rubber product called Cohrlastic FSR, which is a unique form of silicone rubber, fibrous in nature, somewhat resembling sponge and foam in properties.

Cohrlastic FSR is a mat of silicone rubber fibers, oriented in a completely random manner. This random orientation of fibers is said to result in a product which has tensile and tear strength superior to those of silicone sponge and foam. In addition to its improved mechanical strength, the inherent permeability of Cohrlastic FSR suggests applications which cannot be met by sponge or foam.

Some of the properties of Cohrlastic FSR are reported as follows, high permeability; good tear resistance; good tensile strength; density in the range of 20 lbs./cu.ft.; good compression-deflection characteristics; and usable temperature range from —65 to +500° F.

This new product is presently available from pilot-plant equipment in sheets $\frac{1}{4}$-inch thick, nine inches wide, and six feet long. It is anticipated that as applications are developed, Cohrlastic FSR will be made in continuous lengths, larger widths, and various thicknesses. Samples and further data are available from the company.



Examples of Cohrlastic FSR

Increase product durability

Ultra-dispersed Black Masterbatch

With new SYNPOL Black Masterbatches you enjoy many processing cost-savings above and beyond those resulting from reduced Banbury time . . . and you get increased product durability, too. Numerous tests indicate that tires and other products made of SYNPOL Black Masterbatch *outwear* those made from a conventional dry mix. And the use of oil-extended ISAF—completely practical with SYNPOL Black Masterbatches – promises still added improvement in tread wear.

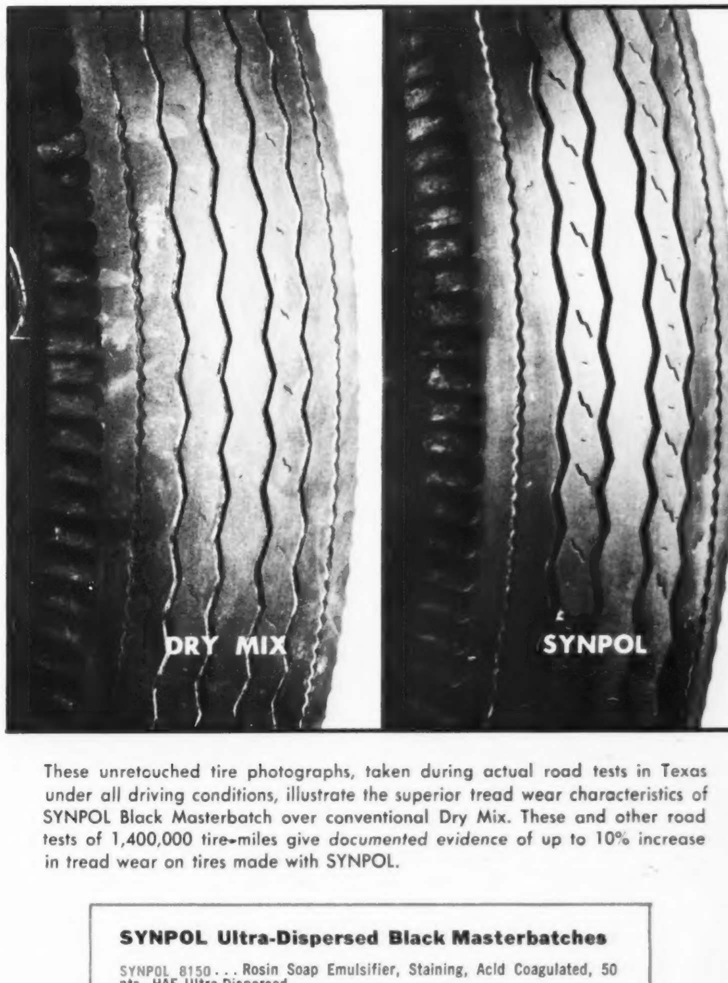
Processing Advantages Include:

- smoother, faster extrusions for equal mixing times
- cleaner in-plant operations
- assured uniformity of stock
- reduced black and rubber inventories, *saving up to 50% in warehousing space*
- new flexibility of operation
- elimination of "cold" batches

End-Product Features Include:

- consistently high abrasion resistance
- resistance to cut growth, flex cracking and heat
- good overall physicals
- low water absorption
- very good electrical properties

The new SYNPOL Ultra-Dispersed Carbon Black Masterbatches have been fully production proved—with more than one hundred million pounds already in use in tires, camelback, and mechanical goods. Start now to enjoy both the processing *and* the product advantages these new SYNPOL Ultra-Dispersed Black Masterbatches offer *you*. For technical data and further information, contact your TEXUS Representative or the address below today.



These unretouched tire photographs, taken during actual road tests in Texas under all driving conditions, illustrate the superior tread wear characteristics of SYNPOL Black Masterbatch over conventional Dry Mix. These and other road tests of 1,400,000 tire-miles give *documented evidence* of up to 10% increase in tread wear on tires made with SYNPOL.

SYNPOL Ultra-Dispersed Black Masterbatches

SYNPOL 8150 . . . Rosin Soap Emulsifier, Staining, Acid Coagulated, 50 pts. HAF Ultra-Dispersed

SYNPOL 8151 . . . Rosin Acid Emulsifier, Staining, Acid Coagulated, 10 pts. Highly Aromatic Oil, 52 pts. HAF Ultra-Dispersed

SYNPOL 8253 . . . Rosin Acid Emulsifier, Non-staining, Non-discoloring, Acid Coagulated, Naphthenic oil-extended, 60 pts. FEF Ultra-Dispersed

SYNPOL 8254 . . . Mixed Soap Emulsifier, Staining, Acid Coagulated, 37.5 pts. Highly Aromatic Oil, 75 pts. HAF Ultra-Dispersed

SYNPOL 8255 . . . Mixed Rosin Acid/Fatty Acid Soap Emulsifier, Staining, Acid Coagulated, 50 pts. Highly Aromatic Oil, 75 pts. HAF Ultra-Dispersed

SYNPOL 8266 . . . Rosin Acid Emulsifier, Staining, Acid Coagulated, 37.5 pts. Highly Aromatic Oil, 75 pts. ISAF Ultra-Dispersed

TEXUS

TEXAS-U. S. CHEMICAL COMPANY

260 Madison Avenue, New York 16, N.Y. • MUrray Hill 9-3322

Executive Offices and Plants: Port Neches, Tex. TEXUS Research Center: Parsippany, N. J.

The severe, ill-fitting "envelope" bathing cap of former days is outmoded. Imaginative styling has taken over, to create a crown of beauty out of new polymers.

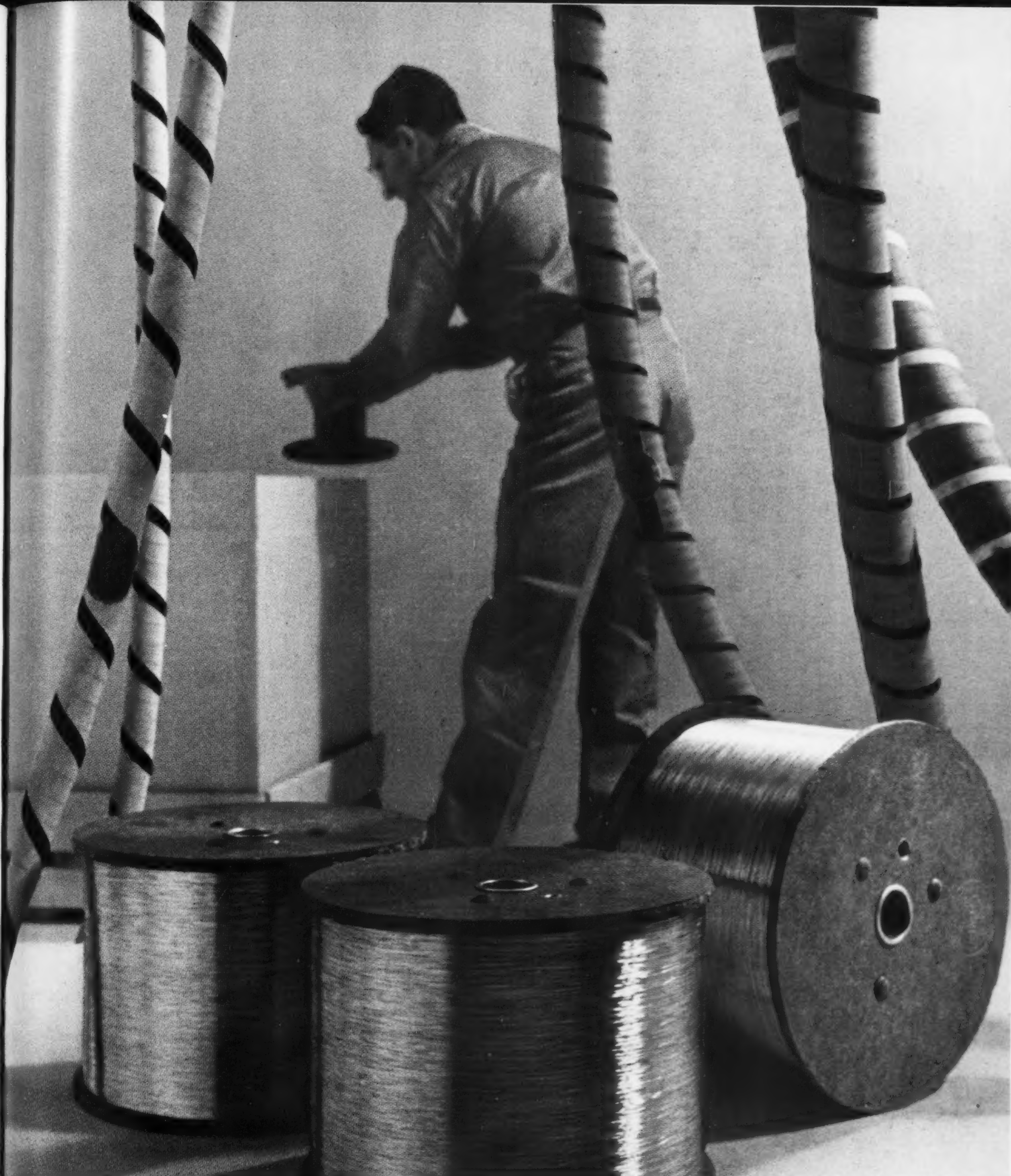
Beauty–in and out of the swim

To achieve the cooling whites and becoming pastels the designer wants, compounders choose TITANOX® white titanium dioxide pigments. TITANOX-RA in particular has really put white and tinted stocks in the swim.

There's rutile or anatase titanium dioxide white pigment in the TITANOX line for any rubber or plastic composition. Our Technical Service Department will be happy to help you select the proper one. Titanium Pigment Corporation, 111 Broadway, New York 6, N. Y.; offices and warehouses in principal cities. In Canada: Canadian Titanium Pigments Limited, Montreal.

TITANIUM PIGMENT CORPORATION
SUBSIDIARY OF NATIONAL LEAD COMPANY

7129



SOUND ENGINEERING

...THROUGHOUT THE WORLD

Since 1940, a total of 74 predip and calendar lines for rayon and nylon tire cord fabric production have been designed and built by C. A. Litzler engineers for leading tire manufacturers throughout the world. In addition to these prime production installations located in 32 countries around the globe, 22 Computreaters — precision laboratory impregnation lines introduced in 1957—have been built for worldwide customers.

All of these production units are in profitable operation today, and a substantial number of them represent repeat orders based on outstanding performance of an initial unit or line.

Designed for clean, highly accurate and rugged performance, these Litzler units qualify, by actual report of the operating engineers, as requiring the lowest maintenance in the industry.

C. A. LITZLER CO., INC.

SOUND ENGINEERING FOR TOMORROW'S PRODUCTION

235 BROOKPARK RD. **CLEVELAND 9, OHIO** **CABLE "CALITZ"**

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Sept

TECHNICAL BOOKS

BOOK REVIEWS

"The Rheology of Elastomers." Edited by P. Mason and N. Wookey. Cloth, 5¾ by 8¾ inches, 202 pages. Pergamon Press, Inc., New York, N. Y., and London, England. 1958. Price, $8.50.

First of all, let it be known that this book will be of interest primarily to research workers in the rubber industry. It is not so likely to be of much interest in development and applied technology departments. It is the proceedings of a conference organized by the British Society of Rheology and held at the British Rubber Producers' Research Association, Welwyn Garden City, May, 1957. The range of subjects is so extensive that the book cannot contain exhaustive treatments of each of them. While this drawback makes the book less essential for a person working in any one of these fields, it broadens the group of people who may be very much interested in parts of it.

The most complete treatment is given to the kinetic theory of rubber elasticity and its applicability to the thermodynamic, photoelastic, swelling, and birefringence properties of rubber and rubber-like deformation. These topics are covered in a series of papers by well-known authorities that make up nearly one-half the book.

Then there are papers on the temperature-frequency relations of visco-elastic phenomena, physical behavior of radiation cured polymers, and the tearing of rubber. Elastomeric properties of gelatin gels, polyethylene, and polyethylene terephthalate are discussed in other articles.

Many of the papers in the book are of very high caliber, and the included discussions are often enlightening. It is a good book to have on hand by anyone doing research work on the physical behavior of elastomers, and it will probably be cited frequently.

K. E. Gui

"Annual Report on the Progress of Rubber Technology." Vol. XXII, 1958. Edited by T. J. Drakeley. W. Heffer & Sons, Ltd., Cambridge, England, 1959. Cloth, 7¼ by 9⅞ inches. Price £1-5s.

This annual report is published for the Institution of the Rubber Industry, 4, Kensington Palace Gardens, London, W.8, England, and contains 23 chapters on the many and various phases of the rubber industry written by outstanding experts in the individual field. To name just a few, there are chapters on synthetic rubber, chemistry of natural rubber, compounding ingredients, testing, fibers and fabrics, tires, footwear, works processes and materials, and machinery and appliances.

The intent and content of the report are quite well expressed in the foreword by T. H. Messinger, chairman of the Annual Report subcommittee, when he reminds the reader that the Report is selective rather than comprehensive, since contributors are instructed to use their discretion in including only such material as, in their judgment, represents real progress.

"Better Report Writing." By Willis H. Waldo. Cloth, 5¼ by 7¾ inches; 238 pages. Reinhold Publishing Corp., New York, N. Y. Price, $4.75.

Here is another book on the very important problem of making reports readable, meaningful, and useful, and has been written by a man who has been very close to this problem for many years. A technical editor and writer who has advised and taught many report writers, he has drawn on this experience to write a very concise book which can be used for quick reference in the future as well as giving much information during the first reading.

Technical Books

Acknowledging that many books and articles exist on the subject, the author expresses in his preface the idea that this small volume is designed for experienced report writers to keep on their desks next to the dictionary so that their composing and revising will be more satisfying and efficient.

The seven chapters cover well the many stages in preparing a report from the considerations which must be given to the form of the final report when the project is first contemplated to the proofreading and production of the completed report. The three appendices containing information on abbreviations, hyphenation, and symbols should prove particularly useful to the busy report writer. The fifth chapter was written by G. G. Hawley, executive director of the Reinhold Book Division and is titled "Put Punch in Your Writing" and is designed to show how the same material can be presented in good readable style rather than in a slow, heavy, or stilted style.

NEW PUBLICATIONS

Publications of the elastomer chemicals department, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.:

"Oil Resistance of Neoprene Latex Compounds." BL-352. By J. C. Carl. 6 pages. The oil resistance of products made from neoprene latex stocks may be varied through a wide range of loading with clay and oil, blending with other oil-resistant latices and adjustment of cure. SAE-ASTM specifications, current and proposed, for Class SC oil-resistant latex compounds can be met by using one or more of these methods. The methods chosen are often controlled by the fluid processing requirements. This report reviews this general subject, with emphasis on dipped goods compounding.

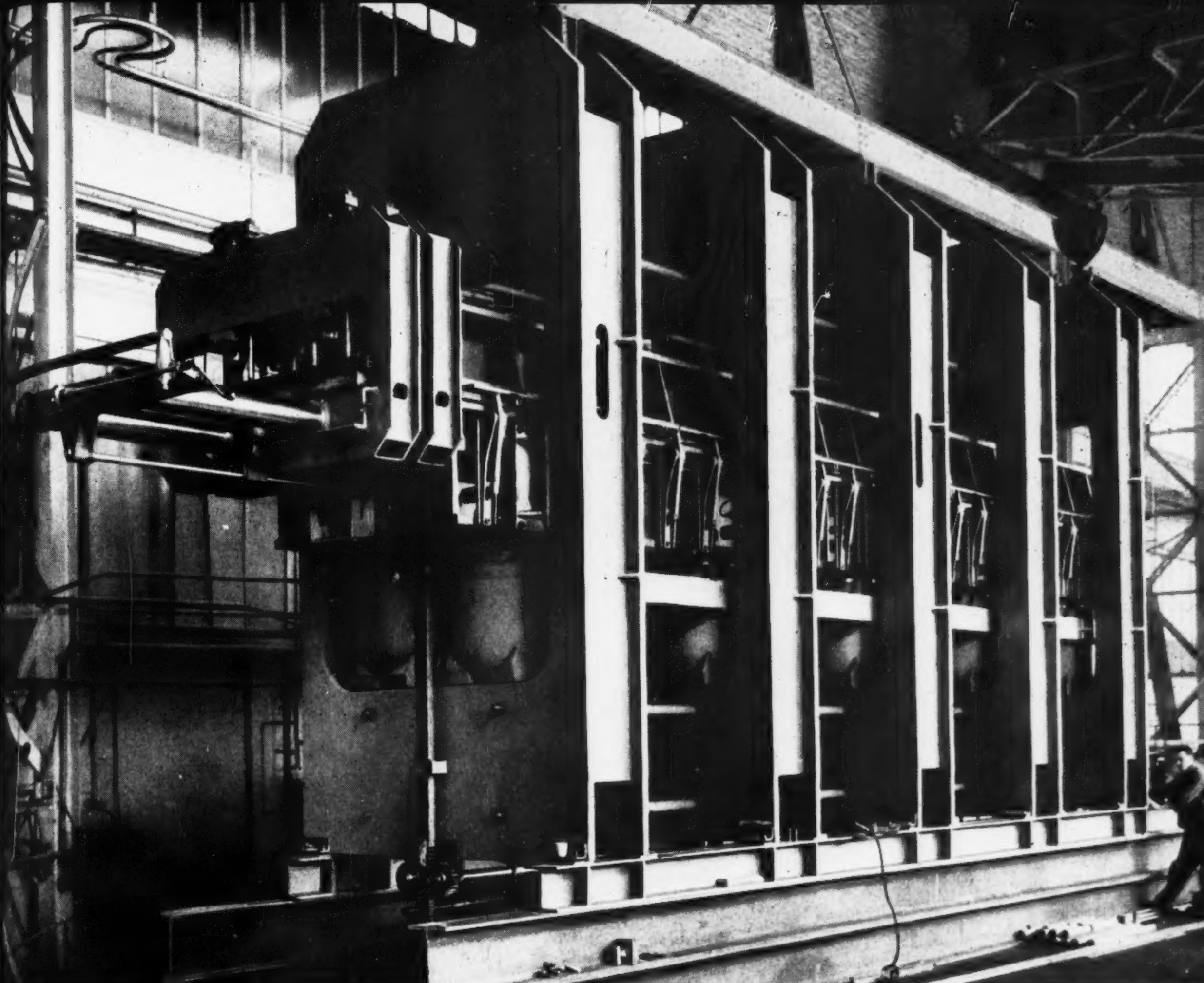
"Low-Water-Absorption Neoprene Compounds." BL-353. By H. H. Klever. 4 pages. Lead-free neoprene compounds having very low water absorption can be made using finely divided silica fillers. Even lower water absorption values are obtained when diethylene glycol and silica fillers are used in combination. Compounding data for the cases are reported in this technical report.

"Blends of Neoprene Types WB and GN." BL-354. By R. M. Murray. 4 pages. Neoprene Type WB is very effective, when blended with other neoprenes, in enhancing extrusion smoothness and in reducing nerve. Better tensile strength and tar resistance result when Type GN is blended with Type WB than has previously been shown for blends with Type W, as indicated in this report.

"Graphical Analysis of Compounding Data." BL-355. By Paul F. Bertsch. 12 pages. This bulletin proposes a method for obtaining the maximum information from elastomer compounding data. It is done by linking experiments together in a graphical design and by graphically analyzing the resulting data. This single case-study of contour plotting describes an evaluation of the MBTS-Tetrone A curing system for Hypalon 20. The starting point is the experimental data in a table; all the plots and graphs come out of this table. The end-product of the analysis is the set of four transparent contour plots enclosed with this report.

"Fluid Resistance of Viton." BL-356. By Edgar Tufts. 12 pages. This report details the fluid resistance of Viton synthetic rubber to a wide variety of oils and chemicals. Viton has particularly good fluid resistance to mineral oils, certain hydrocarbons, esters and ethers. The data presented in this bulletin will aid in preliminary evaluation of Viton for service in contact with fluids.

"Hypalon 40." Report No. 59-2. By P. A. Peffer *et al.* 20 pages. Hypalon 40, a new chlorosulfonated polyethylene elastomer, is described together with its processing characteristics and vulcanizate properties. Compounds for specific products are given. Compared to Hypalon 20, vulcanizates of Hypalon 40 have improved tensile and tear strength, greater elongation, better abrasion resistance, and lower compression set.



Technical Books

Publications of B. F. Goodrich Chemical Co., Cleveland, O.:

"The Effect of Lower Zinc Oxide Level on Physical Properties (for Hycar Compounds)." Hycar Technical Newsletter. Vol. VIII, No. 1, 8 pages. Topics in this Newsletter include: good physicals with less zinc oxide; Hycar and ozone; better impact for polystyrene; and compounding for high temperatures. Recipes and vulcanizate properties and test results are given.

"Hycar Polyacrylic Rubber." Manual HM-3. 34 pages. Sections of this technical data manual include general data, general compounding, processing, compounding for specific applications, and adhesives and coatings. Generally, the Hycar polyacrylic rubbers are useful for temperatures 50 to 100° F. higher than are Hycar nitrile rubbers. Also, an outstanding feature of the former rubbers is that they can perform in sulfur-modified oils at temperatures in excess of 350° F. Recipes and test results of Hycar compounds, in particular Hycar 4021, appear in this manual.

Publications of the General Electric Co., silicone products department, Waterford, N. Y.:

"Silicones." Bulletin CDS-129A. 8 pages. This catalog highlights the company's major silicone products and their uses. Among the uses described are rubber products, including the new RTV silicone rubber; cosmetics and polishes, electrical insulation, water repellents, textile finishes, lubricants, and release and anti-foam agents.

"RTV Silicone Rubber." Bulletin CDS-191. 8 pages. This brochure describes the use of RTV (room-temperature vulcanizing) silicone rubber for the plastic tooling and plastic model making operations. Several case histories are presented which illustrate the successful performance of RTV for a number of diversified molding applications. Also illustrated is a typical sequence of operations required in preparing and applying RTV flexible mold material.

"Silicone Rubber Selector." Bulletin CDS-145. 4 pages. This silicone rubber specification guide is designed to assist engineers in selecting the proper type of silicone rubber for their particular requirements. It contains comprehensive data on applications, typical properties, primary classes, and standard industry and military specifications.

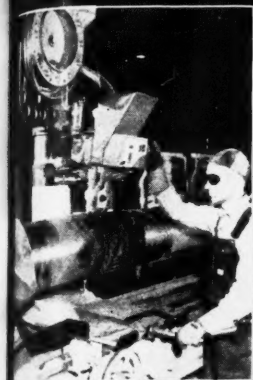
Publications of The British Rubber Producers' Research Association, Welwyn Garden City, Herts, England:

No. 275. **"Stress Relaxation during the Photoxidation of Peroxide Cross-Linked Rubber."** By J. R. Dunn, J. Scanlan, and W. F. Watson. 10 pages. Stress relaxation under the influence of 365 mμ radiation at 25° C. of natural rubber cross-linked with organic peroxides shows the degradative process to be autocatalytic; the presence of oxygen is essential. The stress against time data and the effects of phenolic retarders and catalysts can be represented by a relation derived on the assumption that the degradation is a reaction in an autoxidation mechanism similar to that observed for simple olefins.

No. 281. **"On the Relation between Indentation Hardness and Young's Modulus."** By A. N. Gent. 14 pages. A relation between British Standard and International rubber hardness and Young's modulus is derived from classical elasticity theory and compared with the empirical relation given in B. S. 903: 1950. An experimental examination of the load-indentation relation for a rigid sphere pressed into a flat rubber pad is described. An approximate relation between Shore hardness and Young's modulus is derived similarly.

No. 282. **"Forms for the Stored (Strain) Energy Function for Vulcanized Rubber."** By A. N. Gent and A. G. Thomas. 4 pages. Various forms have been proposed to describe the elastic behavior of vulcanized rubber, but they have been either of limited accuracy or too complex to be mathematically tractable. A new form is put forward in this report which is adequately accurate and fairly simple mathematically and has been used for the solution of an elastic problem involving non-uniform deformations.

(Continued on page 852)



matic rebuilding of rotor replaces old hand methods.

End frames are equipped with new bronze bushings, then line bored after assembly to side.

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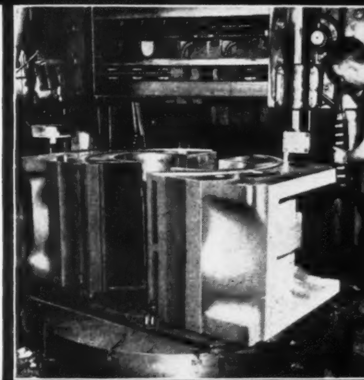
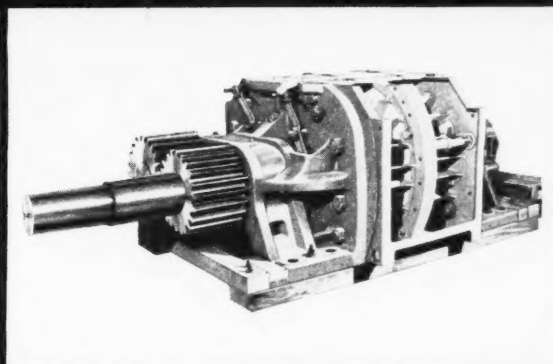


Machining new sides to template.

tors built up and ground to exact ofile.



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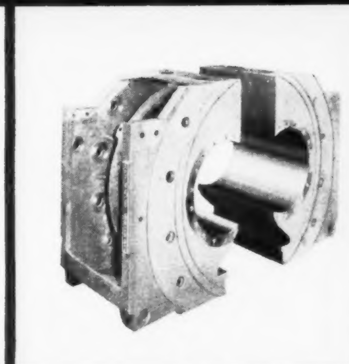

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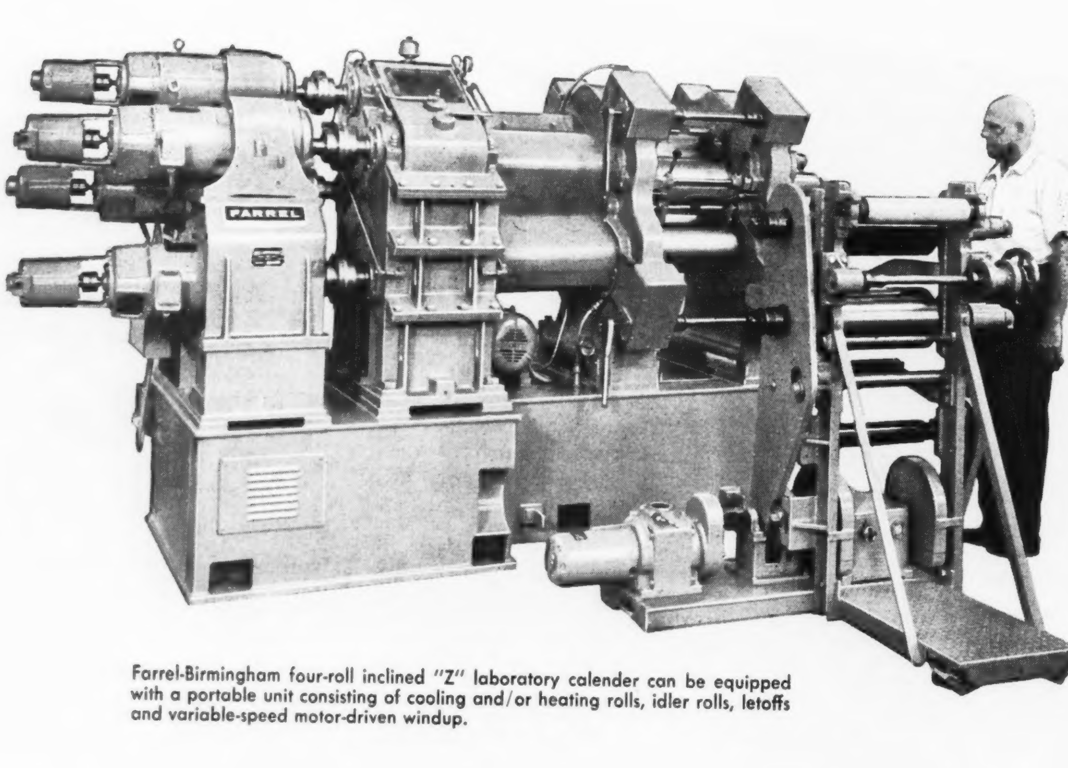
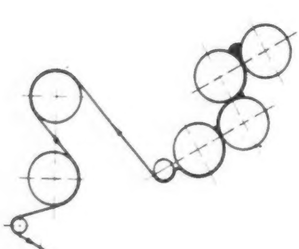
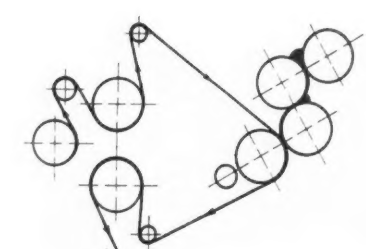


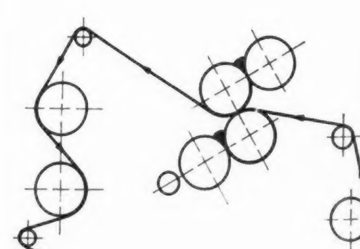
Farrel-Birmingham four-roll inclined "Z" laboratory calender can be equipped with a portable unit consisting of cooling and/or heating rolls, idler rolls, letoffs and variable-speed motor-driven windup.



Film and sheeting



Single coating or frictioning



Double film and sheeting or double coating

Technical Books

(*Continued from page 846*)

No. 276. **"The Interaction of Polymerizing Systems with Rubber and Its Homologues.** Part 4—Acrylonitrile." By P. W. Allen and G. P. McSweeney. 4 pages. Rates and molecular weights for the homogeneous polymerization of acrylonitrile in the presence of dihydromyrcene are shown to conform to the kinetic scheme developed in a previous paper. Previous papers in this series have presented data on rates and molecular weights for the polymerization of styrene, methyl acrylate, and vinyl acetate in the presence of the di-isoprene dihydromyrcene (2,6-dimethylocta-2,6-diene). The results were consistent with the idea that dihydromyrcene functions as a chain transfer agent.

No. 277. **"The Interpretation of Stress-Relaxation Measurements Made on Rubber during Aging."** By J. Scanlan and W. F. Watson. 12 pages. The interpretation of stress-relaxation measurements made during the aging of vulcanized rubbers is complicated by two factors: (1) the deviation of the stress-strain behavior of unswollen rubber from the ideal predicted by elasticity theories and (2) bond formation concurrent with degradation in common types of vulcanizates. The deviations from ideal behavior are now shown experimentally to have negligible effect on the interpretation of the stress-relaxation data. The independence of rate of relaxation at constant extension on the initial extension and other experimental results are in accord with a two-term form for the strain energy, of which a special case is required by the two-network hypothesis advanced by Andrews, Tobolsky, and Hanson to deal with bond formation.

No. 278. **"Crystallization in Natural Rubber.** Part V—Chemically Modified Rubber." By A. N. Gent. 8 pages. Measurements are described of the rate and final extent of crystallization at a temperature of $-25°$ C. in natural rubber which has been modified by the chemical combination of side groups to the rubber molecule. The substances added were six thiol acids. Their efficiencies in retarding crystallization are compared with that previously reported for peroxide cross-linking and with the value predicted by a simple banned volume treatment for crystal nucleus formation. They are found to be generally greater than the large value predicted theoretically. Possible reasons for this are discussed.

No. 286. **"Synthesis of Thia*cyclo*alk-2-enes."** By L. Bateman and R. W. Glazebrook. 4 pages. Substituted thia*cyclo*alk-2-enes have been synthesized by intramolecular condensation of suitably spaced thiol and keto-groups. Attempts to prepare unsubstituted thia*cyclo*alk-2-enes by analogous reactions involving aldehyde groups were unsuccessful.

"Circular 552." Third Edition. National Bureau of Standards, Washington, D. C. 27 pages. This circular lists the standard materials issued by the Bureau and their prices. Information on certified compositions and properties and purchase procedures are given. The circular is available for 35¢ from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Slab Cutter

(*Continued from page 810*)

new guide bar eliminates "flip-up," customarily a problem in making thick cuts.

The new cutter is built for heavy duty, 24-hour-a-day production. Some of its features include a special poly bar for thick section cutting; a motorized dual spindle blade sharpener; 30-inch vertical travel on the cutting head; automatic indexing of the splitting head in 1/64-inch increments; a compression roll that adjusts horizontally to accommodate a range of thicker cuts; and a conveyor belt with a variable-speed control of from 25 to 100 feet per minute when moving into the cutting position and twice that rate on the return.

Color films, information and other data on the machine are available from the company.

RUBBER WORLD

EDITORIAL

Competition of Foreign-Made Products Causes Increasing Industry Concern

COMPETITION of foreign-made products is receiving increasing attention from American industry. Samuel Lenher, a vice president and adviser on research for Du Pont, recently warned that foreign companies have demonstrated their ability to "match our best efforts" and now have a competitive edge because of wage rates which are only a fraction of those in this country.

The Goodyear Tire & Rubber Co., in its employe publication, *The Wingfoot Clan,* ran a series in July on the threat of foreign competition to our rubber products industry. Goodyear emphasized that the invasion of U. S. markets by foreign rubber products is aided by manufacturing costs plus import duties that are still less than the cost of many comparable products made in this country. The biggest single factor in this cost advantage for foreign producers is wage costs, it was added.

Goodyear went on to point out that the hourly wage, including fringe benefits, for its employes in this country was $3.48, as against $1.01 in France, $0.90 in Germany and Italy, and $0.29 in Japan. Even with improved mechanization, American producers cannot match prices with foreign manufacturers for many rubber products. For example, wholesale prices for certain Goodyear products in the United States compare with foreign imports as follows: single-ply steel-cord truck tires, size 8.20-20, $77, against $62; standard size bicycle tires, $2.65 a pair, against $2.18; steel-reinforced ¾-inch steam hose, per foot, $1.49, against $0.76; 24-inch-wide conveyor belting, per foot, $6.50, against $4.85; B-60 V-belts, $1.59, against $1.01.

Goodyear did not offer a solution to this problem, but obviously is hoping that it can maintain its labor costs near their present level, can continue to operate at near capacity in order to keep costs at a minimum, and can be able to allocate as much money as possible to modernization and improved efficiency projects.

Du Pont's Lenher has pointed out that neither "free trade" nor 'isolationism" is a realistic policy today since the United States needs allies in the cold war. We should promote the growth of free nations abroad without, however, jeopardizing our own strength. Specifically, we must not add strength abroad if it means substracting strength at home.

We must remember that the American public buys what it considers the best products with the best service for the least amount of money. American automobile manufacturers lost 9% of their market to foreign producers, mostly because of price, in the recent past. The cost of American cars abroad is very greatly increased, however, by import duties.

As the Du Pont spokesman suggests, the United States should maintain a structure of reasonable tariffs, applied selectively to place incoming products on an even footing with United States goods. The basic criterion for application of such tariffs should be the security of the nation.

R. G. Seaman
EDITOR

RUBBER WORLD

The Influence of Order of Addition Of Rubber Compounding Ingredients At High Mixing Temperatures[1]

By H. C. JONES
The New Jersey Zinc Co. (of Pa.), Palmerton, Pa.

THERE has been a gradual increase in the milling temperatures of rubber compounds in recent years so that currently a large percentage of all rubber stocks reach temperatures well above 300° F. in the normal mixing operation. This situation has been brought about by a number of factors, perhaps the most important of which has been economic. The necessity of processing greater amounts of stock through limited mixing equipment has resulted in higher batch temperatures. Internal mixers have been designed for higher rotor speeds and greater working pressures, and under these conditions substantially higher stock temperatures are developed.

Higher mixing temperatures have also been found advantageous for some types of rubber compounds when a higher level of reinforcement is attained by further cross-linking of the polymer resulting from the elevated temperatures. This has been notably the case with SBR and butyl rubbers.

When it is realized that the mixing temperatures referred to are in the range where the curing agents, sulfur, zinc oxide, organic acids, and accelerators are reactive, some consideration should be given to the or-

[1] Presented before the Division of Rubber Chemistry, ACS, Los Angeles, Calif., May 15, 1959.

The Author

H. C. Jones, head of the rubber and plastics laboratory, research department, New Jersey Zinc Co., received his B.S. in Chemical Engineering and his M.S. in Chemistry from Lehigh University, Bethlehem, Pa.

He joined the New Jersey Zinc Co. immediately after graduation in 1928 and has advanced through the various stages of research chemistry to his present position where he directs the rubber and plastic research for the company. He has been active in pigment development for rubber and plastics and applications studies.

Mr. Jones is a member of the American Chemical Society, the American Society for Testing Materials, and Sigma Xi.

TABLE 1. DESCRIPTION OF COMPOUNDS—ACCELERATORS USED

Base Formula

Smoked sheets	100.0
Zinc oxide*[a]	5.0
FEF black	25.0
HAF black	25.0

MBT[b]	0.8	MBTS[c]	0.8
Sulfur	3.0	Sulfur	3.0
Stearic acid	4.0	Stearic acid	4.0
Pine tar	3.0	Pine tar	3.0
Cure—(30 psi.) 134.5° C.		Cure—(40 psi.) 141.6° C.	
Cyclohexyl sulfenamide[d]	0.5	Methyl Thiuram[e]	0.3
Sulfur	2.5	Sulfur	2.5
Stearic acid	2.0	Stearic acid	2.0
Mineral oil	5.0	Mineral oil	5.0
Cure—(30 psi.) 134.5° C.		Cure—(30 psi.) 134.5° C.	
Morpholine sulfenamide[f]	0.5	Butyl sulfenamide[g]	0.5
Sulfur	2.5	Sulfur	2.5
Stearic acid	4.0	Stearic acid	2.0
Pine tar	3.0	Mineral oil	5.0
Cure—(52 psi.) 148.8° C.		Cure—(30 psi.) 134.5° C.	

[a] N. J. Zinc Co.'s Protox-166, an American Process oxide surface treated with propionic acid.
[b] Captax, R. T. Vanderbilt Co., New York, N. Y.
[c] Altax, Vanderbilt.
[d] Santocure, Monsanto Chemical Co., Akron, O.
[e] Methyl Tuads, Vanderbilt.
[f] Nobs Special, American Cyanamid Co., Bound Brook, N. J.
[g] Santocure NS, Monsanto.

der in which these ingredients are introduced into a rubber batch. It does not necessarily follow that if the sulfur is withheld until the end of the mixing operation or the sulfur is added on a cool mill as an additional milling step, the order of incorporation of the other curatives during the hot milling part of the cycle can be disregarded.

What is the effect of the elevated temperatures on zinc oxide, fatty acid, and accelerators alone or collectively in the natural or synthetic rubber mix? Furthermore, should the carbon black be added early or late in the hot cycle? What is the influence of having the curatives incorporated before or after carbon black, and, finally, what does the type of carbon black have to do with the resulting properties? A study of some of these factors has been made and is reported in this paper.

Previous Work

Holbrook and Fitzgerald[2] studied the effect of high processing temperatures upon the stability of commonly used accelerators. They reported that processing temperatures of the order of 360° F. partially damaged some rubber accelerators and decreased their effective activity. Thiazole derivatives and activated thiazoles show less loss in activity than thiurams and dithiocarbamates. Diphenylguanidine was moderately affected, and aldehyde amines ranged in stability from moderate to good.

More recently Martin and Parkinson[3] reported on the effect of the order of addition of compounding materials during mixing. They studied the effect of order of addition of zinc oxide, mineral oil, stearic acid, and antioxidant in a natural rubber tread stock on Mooney scorch time for mixings over a range from 120 to 195° C. (248-383° F.) The experiment established definitely only one effect, that is, the order of addition of zinc oxide has an important bearing on scorch properties when the stocks are milled hot. Briefly, their Banbury milling results showed that at 195° C. the scorch time was 17 minutes when the zinc oxide was added early and 23 minutes when the zinc oxide was added late. At the lower milling temperature the scorch time was somewhat longer, and the influence of order of addition was negligible.

The Martin-Parkinson investigation directed attention to an interesting property, but it left a number of questions unanswered. What is the influence of order of addition of accelerator and the several specific types of carbon black on scorch properties? Furthermore, in what manner are the physical properties of the cured stocks affected by the milling order of the compounding ingredients?

TABLE 2. MIXING ORDER WITH MILLING TEMPERATURE OF 141.6° C. (287° F.) FOR ALL INGREDIENTS EXCEPT SULFUR. AFTER SHEETING OFF AND COOLING, MILL IN SULFUR AT 42° C. (107.6° F.)

Ingredients	Code
Rubber	SS
Zinc oxide	ZO
Accelerator	Ac
Carbon black	CB
Mineral oil (or pine tar)	MO
Stearic acid	SA
Sulfur	S

Mixing Order	Ingredients						
A	SS,	ZO,	Ac,	CB,	MO,	SA,	S
B	SS,	ZO,	SA,	Ac,	CB,	MO,	S
C	SS,	Ac,	ZO,	SA,	CB,	MO,	S
D	SS,	Ac,	SA,	CB,	MO,	ZO,	S
E	SS,	ZO,	CB,	MO,	Ac,	SA,	S
F	SS,	CB,	SA,	MO,	Ac,	ZO,	S

NR Tread Stock Mixing

In the study of the effect of milling order of ingredients in a natural rubber tread stock with several typical accelerators, the compounds were milled on a six-inch laboratory roll with steam circulating through the rolls at 141.6° C. (287° F.). It was found that a more controlled experiment from the standpoint of order of addition could be carried out on a roll mill than in an internal mixer.

The base compound and the accelerator systems utilized in the investigation are listed in Table 1. Mercaptobenzothiazole (MBT), mercaptobenzothiazole di-

[2] "Stability of Accelerators as Affected by High Processing Temperatures," *Rubber Age* (*N. Y.*), Oct. 1948, p. 57.

[3] "Milling Procedure—Its Effect on Physical Properties," *Rubber Chem. Tech.*, 28, 261 (1955).

Influence of Order of Ingredient Addition at High Temperatures

The use of high-speed internal mixers with high ram pressures for mixing many rubber compounds and the resulting discharge temperatures in excess of 300° F. make an investigation into the effect of the order of addition of the various ingredients of primary interest. This is particularly true with curatives such as zinc oxide, accelerators, and sulfur which are reactive at these elevated temperatures. It has been found that this order of addition can have a marked effect on the processability of the uncured compound and the quality of the finished article.

The work described in this paper indicates that early addition of zinc oxide improves the quality of the rubber compound and contributes to accelerator stability at the higher mixing temperatures. Greater processing safety is gained, however, by late addition of the zinc oxide to the batch.

The influence of milling order of the high-temperature mixing of organic accelerators, notably thiurams and some sulfenamides, has a pronounced effect on the properties of the resultant compounds. The order of addition of carbon black was also found to be a definite factor in these studies, with furnace black behaving differently from channel black. The investigation was primarily based on natural rubber stocks, but some information on cold SBR and butyl rubber mixing is included.

TABLE 3. SUMMARY OF TENSILE AND TEAR MEASUREMENTS—NR TREAD

Accelerators		Mixing Order A	B	C	D	E	F
MBT	Tensile, psi.	3740-1*	3750-1	3635-2	3560-3	3590-3	3740-1
	Modulus, 300%, psi.	2735-2	2735-2	2680-3	2700-3	2790-1	2740-2
	Tear, lb./in.	427-3	438-2	391-5	364-6	464-1	404-4
Order of excellence, each mixing cycle		(2)	(1)	(4)	(5)	(1)	(3)
MBTS	Tensile, psi.	3280-4	3325-3	3240-4	3415-2	3490-1	3470-2
	Modulus, 300%, psi.	2870-2	2650-4	2780-3	2825-2	3040-1	2750-3
	Tear, lb./in.	316-4	348-3	376-2	340-3	410-1	410-1
Order of excellence, each mixing cycle		(5)	(5)	(4)	(3)	(1)	(2)
Cyclohexyl sulfenamide	Tensile, psi	2835-4	3085-3	2860-4	2680-5	3290-1	3125-2
	Modulus, 300%, psi.	2065-4	2260-1	2125-3	1740-5	2235-2	2080-4
	Tear, lb./in.	250-4	323-2	274-3	140-5	377-1	333-2
Order of excellence, each mixing cycle		(5)	(2)	(4)	(6)	(1)	(3)
Methyl thiuram	Tensile, psi.	2515-4	2915-2	2260-5	1030-6	2970-1	2855-3
	Modulus, 300%, psi.	2150-3	2390-1	1965-5	585-6	2280-2	2085-4
	Tear, lb./in.	134-4	223-3	74-5	43-6	305-1	253-2
Order of excellence, each mixing cycle		(4)	(2)	(5)	(6)	(1)	(3)
Morpholine sulfenamide	Tensile, psi.	3220-5	3450-2	3370-4	3250-5	3475-1	3415-3
	Modulus, 300%, psi.	2320-4	2510-2	2390-3	2245-5	2620-1	2500-2
	Tear, lb./in.	403-2	409-2	410-2	364-4	447-1	389-3
Order of excellence, each mixing cycle		(5)	(2)	(4)	(6)	(1)	(3)
Butyl sulfenamide	Tensile, psi.	2970-4	3180-3	3115-3	2915-4	3335-1	3265-2
	Modulus, 300%, psi.	2360-3	2525-2	2145-4	1960-5	2650-1	2630-1
	Tear, lb./in.	313-4	404-1	362-2	343-3	342-3	354-2
Order of excellence, each mixing cycle		(4)	(2)	(3)	(5)	(1)	(1)
Total rating, all accelerators, each cycle		(5)	(2)	(4)	(6)	(1)	(3)

*Order of excellence—A rating scale is used for ease of comparison in this and following tables. For each individual property in this table and for a given accelerator the highest value is assigned a value of 1, and this property for the other mixes rated in descending order. Where the property values are essentially equal, the same rating number is assigned. For example, in the MBT formulations mixes A, B, and F are about equal in tensile strength and at the highest value; so are rated 1. C is rated 2, and D and E rated 3. Each of the other properties listed is rated in the same manner. These ratings are attached to the property value as a suffix number.

Next, the sum of the individual property ratings are totaled for each accelerator in a given mix. For example, in the MBT mixes above: mix A with 1 rating for tensile, 2 for modulus, and 3 for tear produces a total of 6. Similarly B yields a total of 5, C-10, D-12, E-5, and F-7. These totals are then rerated with the lowest total assigned a value of 1 and the others rated in ascending order. Again, for example, B and E with a total of 5 are now rated 1; A with a total of 6 is rated 2, with the final order of excellence rating being A-2, B-1, C-4, D-5, E-1, and F-3 for these mixes using this accelerator.

Finally, all ratings for all accelerators for all six mixing cycles are totaled and rerated to give the order of excellence for each mixing cycle.

TABLE 4. PENDULUM REBOUND—60-MINUTE CURE

(Goodyear-Healey Rebound, ASTM D 1054-55)

	Mixing Order						
Accelerators	A	B	C	D	E	F	Diff.
MBT	74.6-1*	74.0-2	73.4-3	74.0-2	74.6-1	74.0-2	1.2
MBTS	71.2-4	71.7-3	70.6-5	71.2-4	73.4-1	72.3-2	2.8
Cyclohexyl sulfenamide	73.4-3	74.0-2	72.9-4	72.3-5	76.3-1	76.3-1	4.0
Methyl thiuram	70.6-3	70.1-4	67.9-5	62.5-6	71.2-2	72.3-1	9.8
Morpholine sulfenamide	71.7-2	70.6-3	70.6-3	70.1-4	72.3-1	71.2-2	2.2
Butyl sulfenamide	72.3-4	74.0-2	72.9-3	72.3-4	75.8-1	75.8-1	3.5
Order of excellence, overall mixing cycle rating	(4)	(3)	(5)	(6)	(1)	(2)	

* The suffix numbers are individual property order of excellence ratings.

TABLE 5. MOONEY SCORCH AT 250° F.—MINUTES TO A 5-POINT RISE

(ASTM D 927-55T and D 1077-55T)

	Mixing Order					
Accelerators	A	B	C	D	E	F
MBT	10.8-4*	13.3-2	12.3-3	14.3-1	12.3-3	13.3-2
MBTS	21.5-2	21.3-2	22.3-1	20.3-3	19.0-4	18.0-5
Cyclohexyl sulfenamide	17.8-2	17.3-2	19.0-1	19.5-1	13.8-4	14.5-3
Methyl thiuram	5.5-3	3.5-4	9.3-2	†	3.8-4	5.8-3
Morpholine sulfenamide	18.5-2	19.3-1	19.3-1	18.5-2	15.3-3	18.0-2
Butyl sulfenamide	19.8-1	18.0-2	18.8-2	18.8-2	16.3-3	15.8-4
Order of excellence, overall mixing cycle ratings	(4)	(3)	(2)	(1)	(6)	(5)

* The suffix numbers are individual property order of excellence ratings.
† Did not cure.

sulfide (MBTS), n-cyclohexyl 2-benzothiazole sulfenamide, n-morpholine benzothiazole 2-sulfenamide, and n-tertiary-butyl 2-benzothiazole sulfenamide are representative tire compounding accelerators. A thiuram accelerator, tetramethyl thiuram disulfide, was also included in the study. Hereafter the accelerators will be designated by abbreviated forms. The zinc oxide and the accelerator were added before and after the carbon black following the six milling order combinations shown in Table 2.

Rating Based on Stress-Strain, Etc.

To simplify the presentation of the data, the average of five cures (30, 45, 60, 90, and 120 minutes) of the tensile, 300% modulus, and tear resistance is reported in Table 3. All of these compounds were well cured in 30 minutes; so the average values are not influenced by state of cure variations. For example, the best overall compound based on tensile and tear with MBT was the B mix; while the lowest properties were noted for the D mix. In rating all the accelerators, however, the E mix rated as the best, and D the lowest of the compounds. The stock in which the zinc oxide was added before the carbon black developed the best properties; while the lowest physicals were noted for the D mix in which the accelerator was added at the beginning of the cycle. These results suggest that adding the zinc oxide early and the accelerator late in the cycle develops the best physical properties. The lowest physical properties occurred when the accelerator was added at the beginning and the zinc oxide at the end of the cycle.

Since the greatest difference in physical properties was noted between mix D and E, much of the subsequent discussion will be limited to these millings. Visual examination of the stocks indicated that the dispersions of pigments and curatives were satisfactory regardless of the order of milling. This might be anticipated since they were mixed on the laboratory rolls where the unit shear is greater than in factory mixed stocks.

The low physical properties of the D compound can be ascribed to one or more reasons. At the elevated milling temperature there is probably some thermal decomposition or oxidation of the accelerator since it is added at the beginning of the cycle. There is also a likelihood of some loss of accelerator activity due to accelerator adsorption. It should be pointed out that the most critical accelerators with regard to loss in physical properties in the D compound were methyl thiuram, cyclohexyl sulfenamide, and butyl sulfenamide in the order named. A more detailed analysis of the accelerator behavior is covered in the Mooney scorch tests.

Some comment should be made about mixes A, B, and C where the zinc oxide and accelerator are both added before the carbon black. The observations are

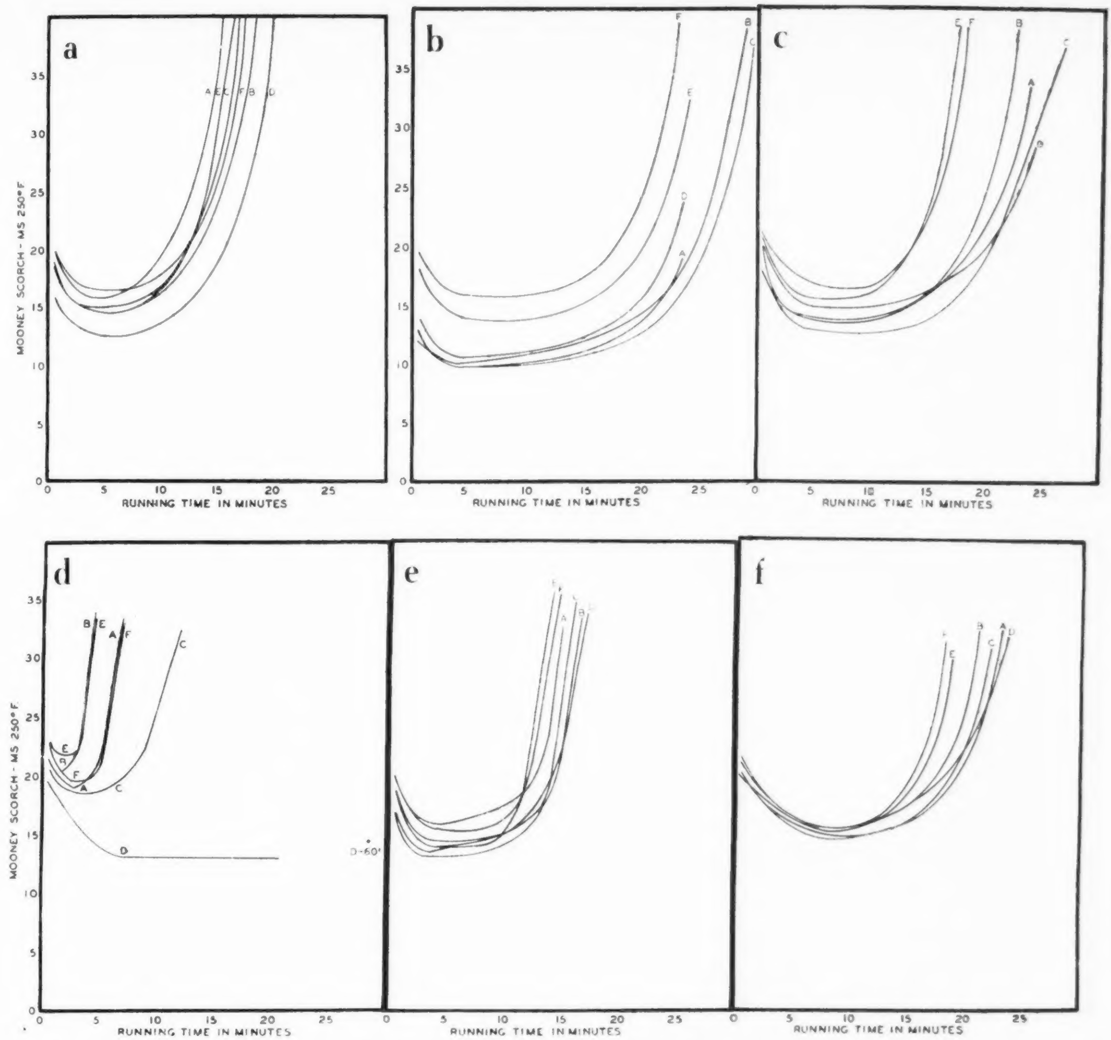


Fig. 1. Mooney scorch at 250° F. for the six orders of milling for each of the accelerators used in the NR tread stock. Accelerators are: a, MBT; b, MBTS; c, cyclohexyl sulfenamide; d, methyl thiuram; e, morpholine sulfenamide; and f, butyl sulfenamide

not so striking or consistent as with mixes D and E where the zinc oxide incorporation is separated from the accelerator addition by the carbon black addition. The pattern, however, is generally similar insofar as behavior with the sulfenamide accelerators is concerned. Significantly better stress-strain properties were developed by adding stearic acid immediately after the zinc oxide addition, as in mix B rather than withholding the fatty acid until later in the batch as was the case in mix A. In other words, the immediate effectiveness of the zinc oxide is increased by having the fatty acid solubilizing agent available. Accelerator, zinc oxide, and stearic acid were added in the order named in mix C. Again there was some sacrifice in properties by adding the accelerator before the zinc oxide.

Ratings on Resilience and Mooney Scorch

The pendulum rebound measurements listed in Table 4 also demonstrate that the E compound in which the zinc oxide is added early has the best, and the D stock where the accelerator is added early had the lowest resilience, and, hence, the poorest quality cure.

A summary of the Mooney scorch data is listed in Table 5. From the standpoint of processability the D stock was the best; while the E compound had the fastest set-up and was therefore the most scorchy.

Milling Order Effect on Scorch

The influence of milling order on the set-up characteristics of the several natural rubber compounds is illustrated more completely in the series of Mooney scorch curves charted in Figure 1. The data also depict interesting plasticity differences resulting from variations in order of addition of the compounding ingredients.

In the group of MBT compounds (Figure 1a) the

TABLE 6. THE INFLUENCE OF MILLING TEMPERATURE ON D AND E MIXING ORDER IN A NATURAL RUBBER TREAD STOCK—STRESS-STRAIN

		D Milling		E Milling	
Accelerator	Tests	Hot	Regular	Hot	Regular
MBT	Tensile, psi.	3560	3650	3590	3610
	Elongation, %	410	405	405	425
	Modulus, 300%, psi.	2700	2835	2790	2655
MBTS	Tensile, psi.	3415	3470	3490	3420
	Elongation, %	375	390	360	395
	Modulus, 300%, psi.	2825	2860	3040	2745
Cyclohexyl sulfenamide	Tensile, psi.	2680	3420	3290	3500
	Elongation, %	425	420	430	410
	Modulus, 300%, psi.	1740	2400	2235	2695
Methyl thiuram	Tensile, psi.	1030	3095	2970	3075
	Elongation, %	465	365	385	380
	Modulus, 300%, psi.	585	2635	2280	2445
Morpholine sulfenamide	Tensile, psi.	3230	3430	3475	3450
	Elongation, psi.	425	410	410	420
	Modulus, 300%, psi.	2245	2520	2620	2475
Butyl sulfenamide	Tensile, psi.	2915	3350	3335	3415
	Elongation, %	420	400	385	390
	Modulus, 300%, psi.	1960	2620	2650	2710

NOTE: Hot milling—141.6° C. (287° F.) roll temperature. Data same as in Table 3. Regular milling—42° C. (107.6° F.) circulating water temperature.

D stock, in which the accelerator was added at the beginning of the batch, had somewhat slower set-up characteristics than the other stocks. Furthermore, this stock develops a somewhat lower plasticity than the other compounds. The interpretation of these results is that MBT is a plasticizer; while the zinc salt of MBT has no softening action on the natural rubber. In the D compound no zinc oxide was present until after the carbon black was added to the batch. The point at which the carbon black is introduced has a dominant influence in the properties of the compound, presumably due to the high-volume percentage of the black and the surface activity of this material.

Noteworthy scorch and plasticity variations were observed in the stocks accelerated with MBTS (Figure 1b). Both the cure and plasticity features of the Mooney scorch curves suggest that there might be adsorption of MBTS on the carbon black. Late addition of the accelerator in compounds E and F developed faster set-up cure characteristics than in the other stocks. The evidence seems to be that when MBTS is added before the carbon black, there is accelerator adsorption, and cure is retarded. This condition does not arise when the carbon black is wet by the rubber before the accelerator is introduced. The curves also depict a pronounced plasticizing effect of MBTS when it is present in the batch before the carbon black. These data again point to the predominating influence of the carbon black and the possible adsorption of the accelerator on the black pigment.

The cyclohexyl sulfenamide compounds in Figure 1c show the same general characteristics as the MBTS data except that the plasticizing effect is less pronounced with the former than the latter. It appears that the retarded cure with mixes A, B, C, and D might be due to adsorption of the accelerator on the carbon black.

The Mooney scorch curves for the compounds accelerated with methyl thiuram are shown in Figure 1d. All of these stocks have the fast cure characteristics of the thiuram accelerator except compound D, which exhibited no cure after 60 minutes at 250° F. These data together with the low tensile results on this compound are evidence of accelerator decomposition. The thiuram accelerator in rubber is converted to a dithiocarbamate which in turn decomposes to the volatile reagents, carbon disulfide and dimethyl amine, and the accelerating action is lost unless an alkali or basic material is present to stabilize the dithiocarbamate. In the compounds in which zinc oxide is present before the accelerator, the decomposition products react to form the powerful accelerating agent zinc dimethyl dithiocarbamate.

With morpholine sulfenamide as the accelerator (Figure 1c) the differences in set-up characteristics of the several stocks are relatively slight except that again the fastest curing compound is E and the slowest D.

The Mooney scorch curves for butyl sulfenamide (Figure 1f) were generally similar to those for cyclo-

TABLE 7. THE INFLUENCE OF MILLING TEMPERATURE ON D AND E MIXING ORDER IN A NATURAL RUBBER TREAD STOCK—MOONEY SCORCH AND MIXING TIME

	Mooney Scorch—MS 250° F. Minutes to a 5-Point Rise				Mixing Time—Minutes			
	D Milling		E Milling		D Milling		E Milling	
Accelerator	Hot	Regular	Hot	Regular	Hot	Regular	Hot	Regular
MBT	14.5	14.3	12.5	16.0	19	19	18	19
MBTS	17.8	18.3	17.3	18.5	16	19	18	18
Cyclohexyl sulfenamide	19.5	17.2	13.7	23.0	20	16.5	19	16.3
Methyl thiuram	no scorch	7.3	3.7	9.3	19	19	21	17.5
Morpholine sulfenamide	20.0	22.5	16.3	19.0	17	19	18	20.5
Butyl sulfenamide	18.7	21.5	16.3	23.5	17.6	20	17.3	18.5

TABLE 8. THE EFFECT OF ORDER OF MILLING IN A NATURAL RUBBER STOCK WITH EPC BLACK

Test	D Milling Hot	D Milling Regular	E Milling Hot	E Milling Regular
Tensile, psi.	3170	3275	3270	3230
Elongation, %	520	525	520	520
Modulus, 300%, psi.	1515	1580	1535	1560
Rebound	69.5	69.5	69.5	68.4

Mooney Scorch—MS 250° F. Minutes to a 5-Point Rise

D Milling Hot	D Milling Regular	E Milling Hot	E Milling Regular
33.5	33.5	31.5	34.0

Mixing Time—Minutes

D Milling Hot	D Milling Regular	E Milling Hot	E Milling Regular
17.3	17.3	18.3	18.5

Formula

Smoked sheets	100.0
Sulfur	2.5
Cyclohexyl sulfenamide	0.5
Stearic acid	2.0
Zinc oxide	5.0
EPC black	50.0
Mineral oil	5.0

NOTE: Hot milling—141.6° C. (287° F.) roll temperature. Regular milling—42° C. (107.6° F.) circulating water temperature.

hexyl sulfenamide. Where the accelerator was added late in the mixing cycle, the compounds were faster in cure properties than in the stocks in which the accelerator was present before the carbon black. There is no evidence of accelerator plasticization in this case.

Additional Low-Temperature Milling Effects

Milling temperature had a marked influence on the properties of mixes D and E as shown by the results in Table 6. Unlike results discussed for mixes milled hot (Table 3), when the stocks were milled at a conventional temperature with water circulating through the rolls at 42° C., the order of addition did not significantly affect tensile and modulus in the natural rubber tread stock. This statement applied to the six accelerators that were tested. Incorporation of the zinc oxide and accelerator early or late in the mixing cycle did not influence the physical properties of the compounds at the lower milling temperature.

The milling time and Mooney scorch values are listed in Table 7. The time required to mix the individual batches was several minutes longer than normal because the operator allowed a slightly longer interval for the separate incorporation of each ingredient than in the usual mixing practice. A comparison of the Mooney scorch data for the high- and low-temperature millings for all accelerators with special reference to two of the sulfenamide type, is significant. As previously mentioned at the high mixing temperature, early addition of the accelerator, as in Table 5, mix D, gave a delayed set-up as compared with the companion stock E where the accelerator was added late in the milling cycle. The reverse was true, however, in the case of the low-temperature (42° C.) mixings in which early incorporation of the accelerator yielded a faster set-up cure than late addition of the accelerator. These data suggest that the accelerator is more effectively utilized in the low-temperature mixings by early rather than late addition of this reagent. From these results it is concluded that the order of addition of the accelerator is of much more importance than the milling order for zinc oxide.

Channel vs. Furnace Blacks

All of the previous mixings were made with a blend of furnace black. In the data listed in Table 8 the natural rubber tread stock was pigmented with EPC black and accelerated with cyclohexyl sulfenamide. It is

TABLE 9. THE EFFECT OF ORDER OF MILLING IN A COLD SBR STOCK WITH FURNACE BLACK

Test	D Milling Hot	D Milling Regular	E Milling Hot	E Milling Regular
Tensile, psi.	3280	3485	3640	3630
Elongation, %	460	435	390	455
Modulus, 300%, psi.	2190	243	2865	2385
Rebound	57.4	57.8	58.9	58.3

Mooney Scorch—MS 250° F. Minutes to a 5-Point Rise

D Milling Hot	D Milling Regular	E Milling Hot	E Milling Regular
53.0	60.0	46.0	66.0

Mixing Time—Minutes

D Milling Hot	D Milling Regular	E Milling Hot	E Milling Regular
20.0	16.0	19.3	16.5

Formula

Cold SBR	100.0
Sulfur	1.75
FEF black	25.0
HAF black	25.0
Zinc oxide	5.0
Stearic acid	2.0
Mineral oil	2.0
Antioxidant	1.0
Cyclohexyl sulfenamide	1.0

NOTE: Hot milling—141.6° C. (287° F.) roll temperature. Regular milling—16° C. (61.8° F.) circulating water temperature.

TABLE 10. THE EFFECT OF ORDER OF MILLING IN A COLD SBR WITH EPC BLACK

	D Milling		E Milling	
Test	Hot	Regular	Hot	Regular
Tensile, psi	3770	4075	4100	4120
Elongation, %	610	525	525	515
Modulus, 300%, psi	1400	1970	1885	1955
Rebound	54.9	51.5	57.8	52.9

Mooney Scorch—MS 280° F. Minutes to a 5-Point Rise

D Milling		E Milling	
Hot	Regular	Hot	Regular
22.5	17.3	13.5	14.5

Mixing Time—Minutes

D Milling		E Milling	
Hot	Regular	Hot	Regular
18.5	16.5	19.3	16.3

Formula

Cold SBR	100.0
Sulfur	1.75
Cyclohexyl sulfenamide	1.2
Stearic acid	2.0
Mineral oil	2.0
Antioxidant	1.0
EPC black	50.0
Zinc oxide	5.0

NOTE: Hot milling—141.6° C. (287° F.) roll temperature. Regular milling—16° C. (61.8° F.) circulating water temperature.

TABLE 11. THE EFFECT OF ORDER OF MILLING IN A IIR 215 COMPOUND

	D Milling		E Milling	
Test	Hot	Regular	Hot	Regular
Tensile, psi	1770	1725	1760	1745
Elongation, %	735	475	555	550
Modulus, 300%, psi	670	1150	985	975

Mooney Scorch—MS 250° F. Minutes to a 5-Point Rise

D Milling		E Milling	
Hot	Regular	Hot	Regular
39.8	28.0	23.8	24.8

Mixing Time—Minutes

D Milling		E Milling	
Hot	Regular	Hot	Regular
12	19	14	15

Formula

IIR 215	100.0
Sulfur	2.0
MBT	0.5
Methyl thiuram	1.0
Petrolatum	2.0
Stearic acid	1.0
SRF black	25.0
FEF black	25.0
Zinc oxide	5.0

NOTE: Hot milling—141.6° C. (287° F.) roll temperature. Regular milling—16° C. (61.8° F.) circulating water temperature.

noteworthy that, with the lower pH black, order of incorporation of the compounding ingredients in the D and E procedure did not influence physical properties or cure. These observations were made with roll mixings at 141.6° C. and at 42° C. It is a possibility that the low pH of the channel black retains the amine portion of the sulfenamide accelerator, and its curing value is not lost by volatility, which is apparently not the case with the furnace black. Studebaker[4] has suggested that the phenolic groups present on the surface of furnace blacks split the sulfur linkages in the accelerator and thereby reduce accelerator activity.

Cold SBR and IIR Mixing

Low-temperature SBR compounds were prepared by the D and E procedures mixed at 141.6 and 16° C., and the data are recorded in Table 9. The pigmentation was furnace black, and the accelerator cyclohexyl sulfenamide. With the cold SBR rubber, the tensile and the modulus of the E mix, zinc oxide added early, was substantially higher than D when mixed at 141.6° C. At the lower milling temperature, 16° C., the D and E mixes, however, were essentially equal in tensile and modulus.

When the cold SBR was compounded with EPC black, the influence of milling order was apparent in the high temperature mixings, with the E mix where the zinc oxide is added early, having a substantially higher tensile and modulus than the D mix (Table 10). Stress-strain properties were not influenced by order of milling when the stocks were mixed at 16° C. It is noteworthy that substantially higher pendulum rebound values were obtained with the stocks mixed at 141.6° C. than those milled at 16° C. It is believed that the quality of the cure and perhaps the bound rubber content have been increased at the higher mixing temperature. The higher bound rubber content is manifested by a greater resilience. Duke[5] has called attention to the development of higher bound rubber in SBR as the temperature of mixing is increased.

A representative IIR (Butyl) compound was mixed hot (141.6° C.) and cold (16° C.) in the D and E procedures (Table 11). The E procedure with the zinc

(*Continued on page 868*)

[4] Merton Studebaker, private communication, Mar. 19, 1959.
[5] Duke, Taft, Kolthoff. "Formation of a Bound Rubber of GR-S Type Polymers with Carbon Black." *Ind. Eng. Chem.*, Dec., 1951, p. 2885.

Cure Profile of Rubber Products[1]

By ROGER W. STRASSBURG
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A STUDY of cure profiles of rubber products requires a method of determining relative state of cure. Since products cured with sulfur represent a major part of all finished rubber goods, a method of preparing cure profiles based on free sulfur analysis should be widely applicable. Where chemical interference occurs in free sulfur analysis, or where cure systems are not based on sulfur, other ways of measuring state of cure, such as swelling of rubber in solvents, must be used.

The determination of free sulfur cured rubber stocks has been reported in a number of papers. Seven of these methods are based on the acetone extraction of rubber to remove the free sulfur for further reaction with oxidizing agents (1-4),[2] with copper (5-6), and with potassium cyanide (7). Two are direct methods which depend on the reactants reaching the free sulfur in the rubber. One accomplishes this by reduction of free sulfur to hydrogen sulfide with tin in acid solution (8). The other is based on the reaction of free sulfur in rubber with sodium sulfite solution to give sodium thiosulfate, which is titrated with standard iodine (9). The sodium sulfite method has been criticized for giving low free sulfur results (10) although 94% completeness of reaction has been claimed (11).

The method to be described here was adapted from the ASTM[3] direct sodium sulfite procedure (12) which is similar to that described first by Bolotnikov and Gurova (9). One restriction is that the accelerator tetramethylthiuram disulfide must be absent. For many applications the ASTM procedure is perfectly satisfactory, but for cases where only very small samples are available, or where rapidity of operation has great importance, certain modifications must be made. Two such cases requiring small samples are (a) non-destructive testing where tire vents or micro cores of rubber are analyzed, and (b) cure profiles of tire cross-sections which demand that the dissection grid on the cross-section be small in relation to the size of the tire. This report is concerned with the determination of cure profiles in tires by free sulfur analysis and some of the problems of developing a method with sufficient precision for such determinations.

Cure Profile

During the curing operation a tire is subjected to a heat cycle in which heat flow from the mold and curing bag determines the extent of cure throughout the tire. Mold design and calculations of heat flow can best be checked with a method of measuring the actual degree of cure of a tire. The cure profile of a tire cross-section is such a method and is based on the determination of free sulfur in each segment of a dissection grid laid out on a tire cross-section. The thickness of the cross-section need only be such that the segment weighs a minimum of 100 mg.

Figure 1 illustrates the dissection grid of 3/16-inch squares laid out on one half of a bus-tire cross-section. The grid size depends on tire size and on the definition desired in the profile. Each segment was then ground to about 20 mesh and analyzed for free sulfur, as described in the appendix following this article. Table 1 shows the results recorded on a chart laid out to simulate the grid on the tire. Inspection of the results at once indicates groups of segments of the cross-section with simi-

[1] Presented before the Division of Rubber Chemistry, ACS, Chicago, Ill., Sept., 1958.
[2] Numbers in parentheses refer to Bibliography items at end of article.
[3] American Society for Testing Materials, Philadelphia, Pa.

The Author

Roger W. Strassburg, manager, general chemical laboratories, The B. F. Goodrich Co., received his B.S. in Chemistry from Iowa State College in 1942 and was awarded a Ph.D. in organic chemistry in 1950 by the University of Minnesota.

Following graduation from Iowa, Dr. Strassburg worked as a research chemist for the United States Rubber Co. from 1942 to 1946. He joined Goodrich in 1950 as a project leader and was promoted to his present position in 1957.

He is a member of the American Chemical Society, Phi Lambda Upsilon, and Sigma Xi.

TABLE 1. TABULAR ARRANGEMENT OF FREE SULFUR DETERMINATIONS (%) CORRESPONDING TO THE DISSECTION GRID ON TIRE CROSS-SECTION IN FIGURE 1

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
A	.21	.21	.16	.16		.15	.18	.17	.17	.13		.15	.14	.15	.12				
B	.27	.28	.23	.23		.22	.29	.25	.26	.22		.23	.20	.20	.15				
C	.26	.23	.24	.23		.26	.25	.27	.23	.21		.20	.23	.18	.18	.15			
D	.22	.23	.24	.24	.26	.28	.29	.30	.31	.26	.27	.26	.25	.25	.23	.20	.15		
E	.15	.15	.15	.15	.16	.16	.17	.19	.21	.22	.23	.24	.24	.24					
F									.14	.15	.16	.17	.19	.20	.20	.20	.19	.15	
G													.12	.12	.13	.15	.16	.15	
H																	.11	.11	
I																			.06

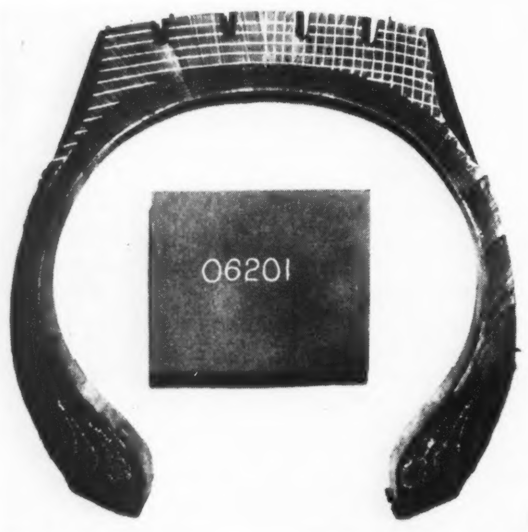

Fig. 1. Tire cross-section with a dissection grid marked on the right half of the tread

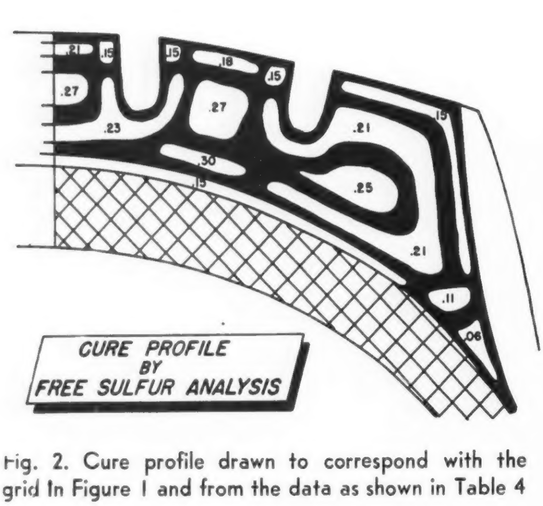

Fig. 2. Cure profile drawn to correspond with the grid in Figure 1 and from the data as shown in Table 4

lar free sulfur content. By enclosing these areas with an "iso-sulf" line a completed cure profile, as shown in Figure 2, is obtained. [The "iso-sulf" lines connecting areas of similar free sulfur content were devised for clarity, and the term "iso-sulf" was coined by Dr. Strassburg after noting the similarity to isobars or isotherms used on weather maps. EDITOR.]

This contour map of free sulfur content presents a picture of degree of cure throughout the section analyzed. Although a total grid study destroys the tire, it is possible to pinpoint a diagnostic area which can subsequently be sampled non-destructively in similar tires. Thus a study of heat transfer in a new mold with a certain curing cycle by preparation of a cure profile can be translated into a control technique in later production.

Discussion

The use of semi-micro free sulfur analysis to determine degree of cure requires high reliability. A statistical treatment of data from a series of free sulfur results early in this study showed that variability was too great for a satisfactory study of cure level. Disguised control samples from the same piece of cured tread were analyzed at intervals over a period of six months. The average for 105 samples was 0.34% free sulfur and represented values from 0.13 to 0.46%. Three σ was calculated to be 0.18 where σ is the standard deviation. Standard deviation is defined by the equation $\sigma = \sqrt{\frac{\Sigma(X - X_i)}{N - 1}}$, where X is the average value, X_i is one of the series of values, and N is the number of values obtained. In a normal distribution of test data σ includes 68.2% of all values equally dispersed from the average. Three σ will include 99.7% dispersion.

This wide variability could rest on any or all of such factors as non-uniform sample size, method of sample preparation, or method of analysis. Sample preparation consisted of passing the cured rubber through a cold, even-speed 6- by 12-inch rubber mill specified to be set at 0.005-inch. Inspection of these milled samples indicated a considerable variation in smoothness and thickness of sheet which appeared to depend on type of rubber, extent of cure, and operator technique.

Any device which would cut rubber into fine, uniform pieces should eliminate this problem if no change in free sulfur occurred during the cutting operation. The Wiley mill (see Appendix) was chosen in preference to a hammer mill because a cutting rather than pounding

Cure Profile of Rubber Products

The degree of cure in rubber can be related to the free sulfur content of the stock after vulcanization. A problem in control work has been, however, to determine this free sulfur without destruction of the part. This paper by Dr. Strassburg describes a process which, by using a rapid semi-micro modification of the sodium sulfite method, can make use of non-destructive sampling of tires or other products, but still produce acceptable results.

The method is also ideally suited to the preparation of cure profiles of rubber parts. By dividing the part into marked small samples, a grid pattern of the free sulfur, or degree of cure, can be plotted. This plot may then be used to pinpoint critical areas of the part with regard to cure. The method may then be utilized to provide control by coring very small samples from these predetermined areas.

The problems faced in trying to grind or cut the samples without causing any change in the free sulfur content are described. The solution found in using dry ice in a Wiley mill is shown to be acceptable and to produce results within statistical control limits.

An appendix containing detailed instructions for sample preparation and analytical procedure is included.

action was believed to be best for producing finely divided rubber. The cutting action produced enough heat in the rubber to decrease the free sulfur content of a sample as much as 0.05%. A search for ways of eliminating this difficulty led to finding that rubber frozen in dry ice could be ground rapidly in the Wiley mill to 20 mesh. Since grinding to 40 mesh was much slower and without significant effect on the results, 20-mesh samples were chosen for evaluation and comparison to the older rubber mill method.

One rubber sample divided into two parts was prepared by each method and analyzed 20 times on different days. Table 2 shows the results of these tests. The drop in 3 σ to 0.0678 from the previous 0.18 is perhaps indicative of more care in milling since this control was not disguised or of a more readily milled stock. The significant fact remained that grinding produced samples which gave a 3 σ value of 0.0285. For a duplicate sample determination the result should be within $\pm$0.02% of the true average. The average value was also 0.05% higher, which indicated a more complete reaction with free sulfur in the case of the 20-mesh grind.

The milling method was replaced by the grinding method based on the above results. Table 3 shows the improvement in precision which resulted from this change. Approximately 99% of the duplicate samples check within 0.01%. In a series of samples such as are found in a cure profile determination single determinations are considered sufficient.

In the chemical analysis, time of reaction of the sample with the sodium sulfite solution was found to be a critical variable. The macro ASTM method from which the method described here was developed specified a 16-hour reaction time for a two-gram sample. Table 4 illustrates the fact that a two-hour reaction time is sufficient for a 50-mg. 20-mesh sample. When the free sulfur content falls in the range of 0.75 to 1.00%, samples smaller than 50 mg. are advantageous for convenience in handling solution volumes, but longer than two-hour reaction times have not been found necessary. Table 4 also demonstrates that a variation in the rate of reaction can occur between different stocks. So far as is known,

TABLE 2. COMPARISON OF MILLING AND GRINDING SAME SAMPLE

	Milling, 0.005-In.	Grinding, 20 Mesh
Average value, free sulfur	0.255%	0.306%
Variation	0.19–0.30%	0.28–0.33%
3 σ	0.0678	0.0285

TABLE 3. COMPARISON OF MILLING AND GRINDING DIFFERENT SAMPLES

Variation in Duplicate Results	4,257 Samples, Milling, 0.005-In.	1,497 Samples, Grinding, 20-Mesh
0.00%	61%	77%
0.01	29	22
0.02	5	1
0.03	2	0
0.04	1	0
0.05	1	0
>0.05	1	0

TABLE 4. EFFECT OF TIME OF REACTION WITH SODIUM SULFITE

	Free Sulfur, %		
Time, Hrs.	A	B	C
½	0.27	—	—
¾	0.31	—	—
1	0.33	0.50	0.34
1½	0.36	0.52	0.35
2	0.36	0.51	0.34
4	0.38	0.51	0.34
6	0.38	0.52	0.36
16	0.38	0.53	0.35

no sample has had such a reduced rate that the two-hour reaction time was not enough. This laboratory always includes control samples in each series of analyses as an added check on reagents and techniques.

Summary and Conclusions

This combination of proper sample preparation with rapid, precise semi-micro determination of free sulfur makes possible the preparation of cure profiles of sulfur cured rubber articles. Once a critical area for state of cure has been located using the profile, non-destructive sampling will give samples which can be used for monitoring cure at that point. Although a tire cross-section was used in the present study, similar useful results have been obtained on test specimens such as hysteresis blocks and tensile sheets.

Acknowledgment

The able assistance of Mrs. Gertrude Hebden, Edward Coakley, Ithel Wright, and Clyde Wiley in this laboratory, the encouragement of R. P. Stock, and the help of V. F. Springer and others are gratefully acknowledged.

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APPENDIX

Sulfur Determination Test Procedure

Sample Preparation

Pre-cool the Wiley mill[4] fitted with a 20-mesh screen by passing crushed dry ice through it. Cut the rubber sample with scissors into approximately ⅛-inch pieces and mix with dry ice in a 250-ml. beaker. After a minimum time of 2-3 minutes, pass the mixture through the mill and add more dry ice to sweep through all the sample. Collect the dry ice and rubber mixture in a properly identified 4-oz. wide-mouth bottle. Use an air jet to clean the mill between samples. The dry ice and sample mixture can be allowed to stand overnight or can be placed in a low-velocity air oven maintained at 110-120° F. Complete removal of dry ice from 24 jars will usually take 2-3 hours if the oven method is used.

Test Method

Accurately weigh 0.0200- to 0.0600-g. of cured rubber ground to 20 mesh and transfer to a 4-ml. test tube. Add 2 ml. of 5% sodium sulfite solution (contains 5% 2B alcohol) with an automatic pipet. Place the tube in a rack which sets in a water bath and allow to stand for two hours. The water bath should be maintained at a temperaure of 80-90° C. by means of a steam plate. Add 2 drops of 5% cadmium acetate solution and 4 drops of 40% formalin. If no precipitate forms, discard the sample and repeat the determination, using an excess of sodium sulfite solution. Centrifuge the solution 3-5 minutes at 3,000 rpm. Decant the supernatant liquid into a 25-ml. Erlenmeyer flask which is cooled in crushed ice. Wash the precipitate in the test tube with 3 ml. of cadmium acetate wash solution (5% solution diluted 1 to 100) and transfer the wash solution to the 25-ml. Erlenmeyer flask. Add 8 drops of glacial acetic acid and 2 drops of starch solution to the flask. Titrate with standard 0.002 *N* iodine which is made daily by diluting the standard 0.02 *N* stock solution. Always run two blank determinations with each group of samples.

[4]Wiley Mill, intermediate size, No. L 4722, fitted with 20-mesh screen. Chemical Rubber Co., Cleveland, O.

Order of Addition

(*Continued from page 864*)

oxide added at the beginning of the mix had a higher modulus than the D mix when milled hot (141.6° C.). At the lower milling temperature (16°C.) the modulus values were in the reverse order, with the D procedure developing the stiffer modulus than the E procedure. In this series of compounds, prevulcanization occurred when only the sulfur was withheld from the hot milling step. Zinc oxide and sulfur were mixed cold in the D mix, and accelerator and sulfur were mixed cold in the E procedure.

Summary and Conclusions

Early addition of zinc oxide and carbon black in the hot mixing cycle yielded the best physical properties. Under these conditions, however, the tendency toward prevulcanization was greatest.

Zinc oxide has a stabilizing effect on the high-temperature mixings as indicated by the excellence of the stress-strain and resilience properties of the compounds. These results were most pronounced with thiuram and sulfenamide accelerators.

The several sulfenamide accelerators exhibited variations in heat stability when mixed at elevated temperatures. The stability characteristics of these accelerators in factory processing, however, does not necessarily parallel the evidence noted in these laboratory experiments.

Furnace blacks behave differently from channel blacks, and the point at which the carbon black is introduced has a definite bearing on the properties of the compound.

These statements apply more specifically to natural rubber compounds since this represents the more extensive part of the program. The evidence from limited amount of work with cold SBR and butyl rubber, however, is that the same statements apply to these synthetic elastomers.

Acknowledgment

The author wishes to acknowledge the care exercised by Clayton H. Rehrig in the preparation and mixing of the rubber compounds.

Fundamental Control Techniques[1]

II—Control Charts—Part 2b

By MASON E. WESCOTT

University College, Rutgers University, New Brunswick, N. J.

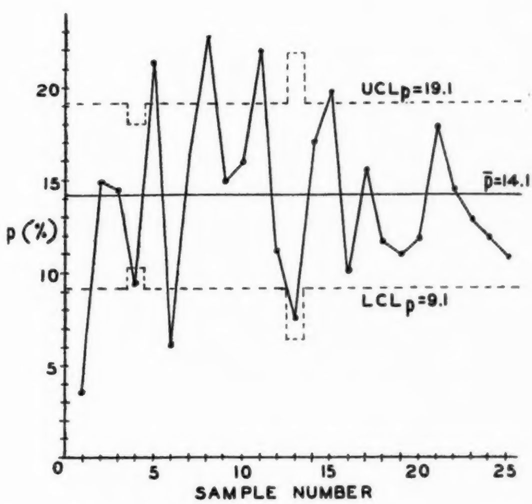


Fig. 2. A fraction defective or "p" chart for a variable sample size

THE PROBLEM OF VARIABLE SAMPLE SIZE. Call the appearance of a "tail" on a penny a "defective." Whether you toss 10, 20, or 50 pennies, the average *percentage* of defectives you can expect to get in a series of tosses will be pretty close to 50%. But the *variation* you may expect to get in fraction defective from toss to toss will certainly depend on whether you are tossing 10, 20, or 50 pennies each time. We have to give chance more elbow room for variation if only 10 pennies are used as a sample than we will if our "sample" is 10.

What this amounts to is that on a p chart, complications arise when n varies. Here the difficulty is with the control limits. These limits involve the formula $3\sigma_p = 3\sqrt{\bar{p}(1-\bar{p})/n}$. It does not take a college education to see that even with $\bar{p}$ remaining constant, the value of this expression will change every time n changes. Furthermore, as n increases, $3\sigma_p$ will decrease; and as n decreases, $3\sigma_p$ will increase. Thus as sample size gets *larger,* the control limits on a p chart come *closer together;* and as sample size gets *smaller,* the control limits *spread further apart.* To be theoretically correct, a p chart based on variable sample size would have a fixed central line, but the control limits would zig-zag all over the chart, changing direction every time n changed. Such a chart would be anything but popular around the shop! You will find examples of such charts in Grant,[2] pages 30 and 232.

A compromise that is generally quite satisfactory consists of basing control limits for the p chart on an *average* sample size, $\bar{n}$. This gives control limits parallel to the central line over most of the chart. It may be necessary to make an adjustment, i.e., a break, in these level control limits when either (1) a particular sample point is based on a sample size, n, that is too far away from the average value, $\bar{n}$; or (2) a particular sample point plots very close to the limits based on $\bar{n}$, and it is desired to make a correct comparison to see if the point is really in or out of the true limits based on its particular sample size. It is fairly common practice to agree that when the subgroup size differs from $\bar{n}$ by more than 25% of $\bar{n}$, that particular sample point is a candidate for special consideration as to proper control limits, subject to the two conditions mentioned above. Of course, if the sample point plots close to the central line on the chart, it will generally not need special examination, because it is almost certain to be in control for any of the n's used in the calculation of $\bar{n}$.

Table 3 shows the essential data needed to make a p chart with control limits based on average sample size. These data represent the percentage of daily production rejected at a 100% inspection of a component part of an electrical device. The part was inspected for five quality characteristics; failure of the part to conform on one or more of these tests was a cause for rejection. The data give $\bar{p} = 14.1\%$, with $UCL_p = 19.1\%$ and $LCL_p = 9.1\%$ based on the average sample size $\bar{n} = 438$. Then $\bar{n}$ plus 25% of $\bar{n}$ or $(1.25)\bar{n} = 548$ and $\bar{n}$ minus 25% of $\bar{n}$ or $(0.75)\bar{n} = 328$; so subgroups over 548 and under 328 in size are marked with an asterisk on the data sheet. Investigation of these 11 cases quickly shows that only samples 4, 6, and 13 need be questioned. On computing the true limits for these three cases, it turns out that only #4 and #13 have limits that change the story. Based on $\bar{n}$ limits, it is shown at the bottom of Table 3 that #4 is *within* and #13 is *outside* the control band. Based on true limits relative to their respective sample sizes, #4 is *outside* and #13 is *within* the corrected control limits.

Figure 2 shows the corresponding p chart with $\bar{n}$ limits corrected for samples 4 and 13. The last 10 points are all in control at a level of $\bar{p} = 13.1\%$. If it can

[1] Continued from our Aug., 1959, issue, p. 717.
[2] "Statistical Quality Control," E. L. Grant. McGraw-Hill Book Co., Inc., New York (1952).
[3] "Engineering Statistics and Quality Control," I. W. Burr. McGraw-Hill (1953).

TABLE 3. DATA FOR A P CHART WITH N VARYING

Sample No.	n	d	p(%)	Sample No.	n	d	p(%)
1	528	19	3.6	16	412	42	10.1
2*	626	93	14.9	17	378	59	15.6
3*	135	20	14.5	18	426	50	11.7
4**	720	68	9.4	19*	127	14	11.0
5	530	113	21.3	20	415	49	11.8
6*	296	18	6.1	21	457	82	17.9
7	451	74	16.5	22*	683	99	14.5
8	474	108	22.8	23	485	62	12.8
9*	559	83	14.9	24*	767	91	11.9
10	423	68	16.0	25*	229	25	10.9
11	412	91	22.0		10943	1547	
12*	290	32	11.2				
13**	184	14	7.6				
14	432	73	17.0				
15	504	100	19.8				

$$\bar{p} = \frac{1547}{10943} = 0.141 = 14.1\%$$

$$\bar{n} = \frac{10943}{25} = 438$$

$$1.25\bar{n} = (1.25)(438) = 548;\ 0.75\bar{n} = (0.75)(438) = 328$$

$$3\sigma_p = 3\sqrt{\frac{\bar{p}(1-\bar{p})}{\bar{n}}} = \frac{3\sqrt{(0.141)(0.859)}}{\sqrt{438}} = \frac{3(0.348)}{20.93} = \frac{1.044}{20.93} = 0.050$$

$$\left.\begin{aligned} UCL_p &= \bar{p} + 3\sigma_p = 0.141 + 0.050 = 0.191 = 19.1\% \\ LCL_p &= \bar{p} - 3\sigma_p = 0.141 - 0.050 = 0.091 = 9.1\% \end{aligned}\right\}\ \text{based on } \bar{n} = 438$$

For sample #4:

$$3\sigma_p = \frac{1.044}{\sqrt{720}} = \frac{1.044}{26.83} = 0.039 \quad \left\{\begin{aligned} UCL_p &= 0.141 + 0.039 = 0.180 = 18.0\% \\ LCL_p &= 0.141 - 0.039 = 0.102 = 10.2\% \end{aligned}\right.$$

For sample #13:

$$3\sigma_p = \frac{1.044}{\sqrt{184}} = \frac{1.044}{13.56} = 0.077 \quad \left\{\begin{aligned} UCL_p &= 0.141 + 0.077 = 0.218 = 21.8\% \\ LCL_p &= 0.141 - 0.077 = 0.064 = 6.4\% \end{aligned}\right.$$

be anticipated that daily production will average close to 440 units per day, it would be reasonable to choose trial standards of $p' = 12.5\%$ and $n' = 440$ and set up a blank chart based on these standards for the next 20 to 30 samples. If the points, as they are posted on the chart, seem to be conforming pretty well to the 12.5% level, it would be a simple matter to make such adjustments in control limits from day to day as are called for by the considerations we have been discussing. If the process shows a marked tendency to shift away from the trial standards, it would be wise to operate on process values, $\bar{p}$ and $\bar{n}$, until such time as reasonable evidence of stability in the process begins to show up.

In p chart work it is desirable to begin to operate on standard values as soon as possible, but with varying sample size, one has to be reasonably certain that the standard, p', is being approximated by the process in order to make correct decisions regarding points that are marginal with respect to control or that are based on sample sizes differing widely from the standard average, n'. The best way to learn how to make and operate a p chart based on variable sample size is to actually *make* and *use* one for awhile. You will soon find that using a p chart with limits based on average sample size, and corrected as occasion requires, becomes just as routine and meaningful and helpful as any other of the Shewhart charts (Grant,[2] page 3 and Chapter IV).

2. The Number of Defects per Unit, or c Chart

NATURE AND CONSTRUCTION OF A C CHART. How many defects *could* there be in a radio set, an automobile, an airplane, or a tractor? How many defects *could* there be in a roll of paper, a bolt of cloth, a mile of insulated wire, or a pane of glass? Theoretically, the answer to each of these questions is "Infinitely many." But if the manufacturing process that turns out these various articles is any good at all, how many defects in the examples cited do you really expect to find? The answer is, "Relatively few."

Now whenever the number of defects we *expect* to find in some unit of production is relatively small compared with the total number that *could* occur in that unit, we have a situation in which the appropriate control chart to be kept is the *number of defects per unit, or c chart*. The unit of production may be a sub-assembly, a final assembly, a length, an area, or a bulk. The essential thing is that the unit, whatever it is, must be potentially capable of possessing an indefinitely large number of defects. Quality for this unit is then measured by *counting* the number of specified kinds of defects actually observed by an inspection of the unit. The fewer the number of defects found the better the quality. The defects themselves may be measurable or visual; all we do is make the appropriate test and put

down a tally mark if the defect in question is found to be present. The inspection may be for just one defect or for several. Thus, we may count *all* the defects found at a final inspection of an airplane, or we may wish to keep a separate record of the number of missing rivets observed at this final inspection.

Once the unit of production, or "area of opportunity" for the occurrence of a defect, has been defined, and the type of defect (or defects) to be looked for in this unit has been specified, we are ready to begin inspection and collect data. The data sheet for a c chart is particularly simple. All it needs, in addition to an appropriate heading, is a column for sample (or unit) identification, a column for the number of defects found, and provision for remarks or comments that would serve to supplement the data in certain cases. If more than one defect is covered by the inspection, provision should also be made on the data sheet for a breakdown by type of defect similar to that shown in Table 1 for the enameling process.

Table 4 shows the essential data from a record form for a c chart. These data were collected at a sub-assembly inspection station in the production of a radio set. The "unit" of production inspected consisted of 5 partially assembled sets. The number of defects, or c, column includes defects of all types observed at the inspection. The breakdown by class of defect is not shown. Thus, sub-asembly unit #1 consisted of 5 sets on which a total of 77 defects of all types were found; sub-assembly #2 consisted of another 5 sets on which a total of 64 defects of all types were found, and so on.

The reason for using 5 sets as the inspection unit rather than a single set will be explained presently. The point to remember, however, is that we are *not* dealing with a sample of 5 in this problem, but rather with a *single unit of production* which consists of 5 sets. The distinction may *seem* academic, but it is not: there is no such thing as sample size, n, in c chart work, there is only a specified *unit* for inspection purposes, and it is the number of defects observed in this unit that counts. Sometimes, as in this problem, it is desirable for purposes of getting a useful c chart, to lump together several of what might be considered "natural" production units to form a single inspection unit. No matter how you choose to regard it, what you always get in a case like this is the number of *defects per unit*, not the number of *defectives per sample*.

The central line on a c chart is designated as $\bar{c}$ and defined by

$$\bar{c} = \frac{\text{total no. of defects observed in all units inspected}}{\text{total number of units inspected}}$$

Table 4 shows the value of $\bar{c}$ for each series of 25 inspection units. There is no objection to saying, for instance, that the number of defects per *set* averaged 11 over the first 125 sets inspected, but the *chart* will be concerned with an average of 56 defects per unit of 5 sets over this run.

Control limits on a c chart are given by the formulas

$$UCL_c = \bar{c} + 3\sqrt{\bar{c}}, \text{ and } LCL_c = \bar{c} - 3\sqrt{\bar{c}}$$

TABLE 4.

Number of defects (all types) found at sub-assembly inspection of radio sets; 5 sets = 1 inspection unit

Sub-Assembly No.	No. of Defects	Sub-Assembly No.	No. of Defects
1	77	26	26
2	64	27	23
3	75	28	9
4	93	29	15
5	45	30	63
6	61	31	39
7	49	32	58
8	65	33	61
9	45	34	59
10	77	35	51
11	59	36	33
12	54	37	40
13	41	38	40
14	87	39	46
15	40	40	32
16	22	41	46
17	92	42	49
18	89	43	31
19	55	44	36
20	25	45	41
21	54	46	49
22	22	47	39
23	49	48	49
24	33	49	43
25	20	50	43
	1393		1021

Summary

Points 1–25

$\bar{c} = \frac{1393}{25} = 55.7$

$\sqrt{\bar{c}} = 7.5$

$3\sqrt{\bar{c}} = 22.5$

$UCL_c = 78.2$

$LCL_c = 33.2$

Points 26–50

$\bar{c} = \frac{1021}{25} = 40.8$

$\sqrt{\bar{c}} = 6.4$

$3\,\bar{c} = 19.2$

$UCL_c = 60.0$

$LCL_c = 21.6$

For the next 25 points, adopt trial standards $\begin{cases} c' = 36 \\ UCL_c = 54 \\ LCL_c = 18 \end{cases}$

These are particularly simple formulas to use. They set limits within which the number of defects per unit can be expected to vary from unit to unit if only causes of variation natural to a process operating at a level of $\bar{c}$ are present. They are 3-sigma limits; so it follows that $\sigma_c = \sqrt{\bar{c}}$. Table 4 shows the values of these limits for each series of 25 units inspected.

It is always an advantage to have a lower limit on an attribute chart when possible. Points outside a lower limit may lead to the discovery of ways to improve quality, and they always serve as a check against relaxation of inspection standards. From the formula for LCL_c it is easy to see that LCL_c will be greater than zero if $\bar{c}$ is greater than 9. However, $\bar{c}$ equal to or greater than 15 is better, because then LCL_c is 3.7 or more, so that there is some elbow room between zero and the LCL_c. This is the reason 5 tests were taken as the unit for the radio-set c chart. With the unit chosen this way, the chart has a useful lower limit; with a single set as a unit, the lower limit would be too near zero to be useful as a control limit.

Figure 3 shows the completed c chart. Improvement over the last half of the chart is evident. Assuming that inspection standards have not relaxed, the chart shows the process operating in good control from the 34th point on. Whether or not control at this level is satis-

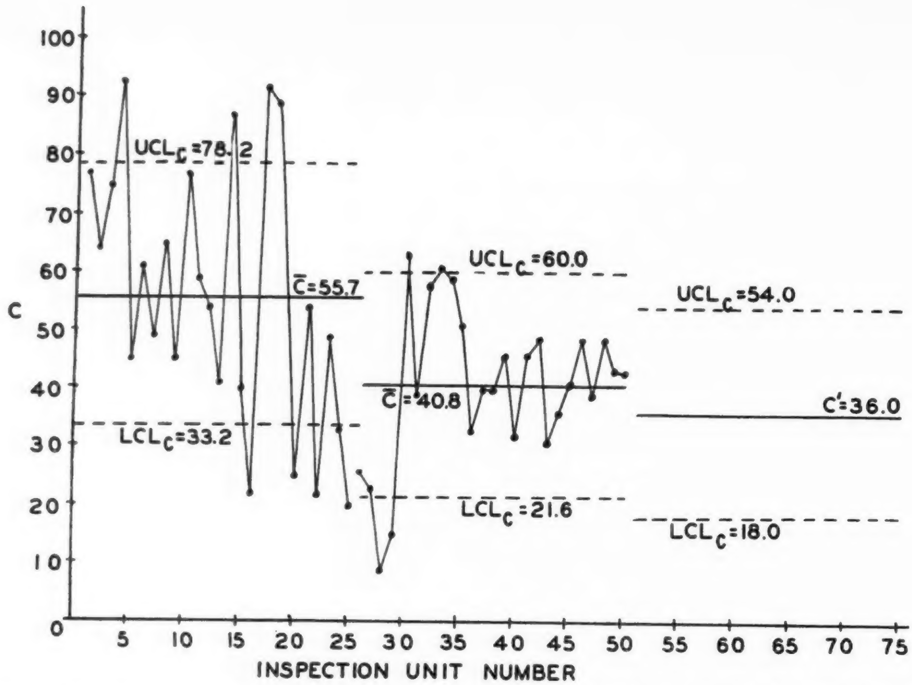


Fig. 3. The number of defects per unit or "c" attribute chart for the sub-assembly inspection of radio sets from the data in Table 4

factory depends on cost considerations as discussed earlier in this paper. At any rate, the chart shows a trial standard number of defects per unit set at $c' = 36$. If this is a satisfactory standard, attention should then be focused on *maintaining control* at a level somewhere between $c' = 36$ and 40, regarding any further improvement in process level as a by-product of the effort to maintain control rather than as a primary objective.

PRODUCT VS. PROCESS UNDER ATTRIBUTE INSPECTION. In discusing both the p chart and c chart we have concentrated our full attention on the use of these charts to study and improve a *process:* nothing has been said specifically about disposition of nonconforming *product* turned up by the inspections that lead to these charts. Disposition of non-conforming product is generally not a problem that is primarily statistical in character. Rather, it is a problem falling within the province of management policy to resolve. If the p chart for a run of points shows a stable state of control at an average of 14% defective, what should be done about the product turned out by this process? If a c chart for a run of points shows a stable state of control at an average of 56 defects per unit of product inspected, what should be done about the product turned out by this process? Is such product good or bad? Should it be shipped, sorted, reworked, scrapped?

Clearly, this is a quality/cost problem, but it is not a *statistical* problem—it is a problem of quality standards relative to the economic environment surrounding the particular item in question. With variables data there is generally associated a clearly defined set of standards or specifications; so disposition of product from a process not operating in satisfactory control is almost automatically dictated by the nature of the non-conformance. But what *are* the standards for quality when the inspection procedure merely classifies items as good or not good (p chart data) or merely counts the number of defects per unit inspected (c chart data)?

Statistical quality control under attribute inspections can only report what the *process* is doing and *(if the process operates in control)* what prediction can be be made about the quality of uninspected items as measured by the average % defective or the average number of defects per unit in lots turned out by the process. What to do about this *product* is definitely a management decision; what to do about the *process* is both a management and a quality control responsibility.

Summary and Conclusions

It has only been possible to "hit the high spots" in this presentation of the subject of attribute charts. But enough has been said to suggest that they are a fundamentally simple and widely useful form of control chart, easy to keep, and easy to explain to shop personnel. They give the beginner a tool with which he can immediately start experimenting with quality control in a way requiring no special equipment or change or interruption in current plant procedures. Like a faithful hunting dog, these charts can often be used, even by a novice, to "smell out" hitherto unsuspected sources of quality trouble in a production process. Thus exposed, the sharper tools of measurement charts can often be put to work on such sore spots, with telling effect in quality improvement.

For those interested in exploring this whole subject of attribute charts more thoroughly, Chapters IX, X, XI, of Grant[2] and Chapters 8, 9, 10 and 11 of Burr[3] are recommended as sources worth consulting.

MEETINGS and REPORTS

Southern RG Panels Discuss Black MB, High-Speed Cures

The June meeting of the Southern Rubber Group was held in St. Petersburg, Fla., on June 5 and 6 at the Colonial Inn and Desert Ranch. About 170 members were joined by families and guests to make the total attendance about 300. Although the time and the place allowed those in attendance an unusual opportunity to enjoy themselves, two very worthwhile and well-attended technical sessions were held; officers and directors were elected

The symposia covered "Recent Developments in Black Masterbatch" and "High-Speed Vulcanization."

Officers elected for the coming year include: Eldon Ruch, Firestone, Memphis, Tenn., chairman; Roger Pfau, Texas-U.S., Memphis, vice chairman; Martin Samuels, Copolymer, Baton Rouge, La., director-manufacturer; Bob Camp, Goodyear, Gadsden, Ala., director-manufacturer; and Charles White, Cabot, director-supplier.

Black MB Developments

The first technical session on June 5 was on "Recent Developments in Black Masterbatch" and consisted of three papers, one on dispersant-type master-batch, one on non-dispersant-type masterbatch, and one on the compounding of the black masterbatches. Moderator for this panel was W. A. Steinle, United States Rubber Co.

"The Production of Dispersant-Type Black Masterbatch" was the subject handled by R. A. Forrester, United Rubber & Chemical Co., and he divided it into six sections for presentation: (1) the nature of dispersing agents and their action, (2) slurry character using dispersing agents, (3) manufacture of masterbatch, (4) some production advantages to the producer in the use of dispersing agents, (5) processing and stress-strain properties, and (6) quality comparisons.

In discussing the nature of the dispersing agents, the speaker pointed out that carbon black has a strong tendency to agglomerate when put into water so that a means of keeping the particles separated is needed. The dispersing agent effects this separation by surrounding the particle with at least a part of itself. In the case of carbon black, anionic types are used as opposed to cationic or non-ionic active types of dispersants used in other fields.

The slurry character is determined by the fact that carbon black is hydrophobic. It does not mix readily with water. About 5% black can be mixed into water without difficulty, but as the black percentage is increased, the wetting rate slows down, and the slurry becomes a paste. Dispersing agents permit slurries with up to 19% solids content to be made with faster wetting of the black and lower viscosity. Originally about 2% dispersing agent on the black was used, but now the level has been lowered to about 1.2% for HAF, 0.8% for channel blacks, and 0.6% for SRF. A major good point in use of dispersants is that the slurries may be stored for several hours before use without thickening and may be piped for long distances. Another good point is that the agents, through their action, produce black particles of less than one micron in diameter.

The manufacture of the masterbatch is essentially a two-step operation. The first step is to prepare the carbon black slurry. The second is to add the slurry to the latex along with other additives and to finish the product properly. The black slurry is made by metering the pelleted black to a Mikropulverizer.[1] The powdered black next drops into a water-dispersing agent solution and is wet out in a continuous stream. It is then pumped into large storage tanks where the dispersing agent continues its work and the mixture is blended and stored for use.

The second step in the manufacture is the coagulation system. This is performed in the same manner as for unpigmented polymer latex. The streams of latex, black slurry, oil emulsion, and antioxidant are metered into the blending tank. The mixture is creamed with brine and coagulated with mineral acid and then goes through a conversion tank for changing the soap to organic acid. Finally, the coagulated crumb goes through the normal steps of draining water, filtration, washing, and hot-air drying. Drying is a particularly critical step. One of the advantages of dispersant masterbatches however, has been the convenience of the finishing operation.

Advantages claimed for this type of masterbatch production, according to the speaker, include, in slurry preparation and handling, (1) preparation of higher solids slurries, (2) storage for sufficient time to permit equalization of solids content, and convenience in movement and metering, and (3) the ability of the dispersant-type plant to be more flexible since the flow of the slurry into the base latex can be stopped or adjusted, thus producing different types of masterbatches more easily. The speaker did suggest, however, that the large number of variations now being offered should be reduced rather than increased in the interest of production economy and efficiency.

As for production advantages in the coagulation step, the dispersants may be a help or a hindrance. When used in proper amounts they help by producing a large crumb that can be dried more readily. Excessive use of dispersants, however, means the opposite or small-crumb size and hard-to-dry material.

[1] Metals Disintegrating Co., Pulverizing Machinery Division, Summit, N. J.

Fig. 1. Carbon black masterbatch panel at SRG meeting: *(left to right)* R. A. Forrester, M. E. Samuels, W. A. Steinle, and R. T. LaPorte

The good processing qualities of the dispersant-type black masterbatches in the consumer's plant have been well established, according to this speaker. He stated that these masterbatches have produced well-dispersed, smooth-processing stocks of a very uniform nature. He warned against trying to compare masterbatches or trying to demonstrate the superiority of one over another unless care has been taken to insure that all are based on the same polymer. He gave examples of differences between stress-strain results with the same polymer from different producers and differences in masterbatches made from the same-type latices from different producers to illustrate this problem. It was suggested that a masterbatch that shows unusual properties, either good or bad, should be examined for loading discrepancies.

Data were shown to indicate that there is little or no effect on cure by the dispersing agents used. The dispersant-type masterbatches, as now produced, generally show a fast rate of cure. With customers submitting requests to masterbatch producers for certain Mooney, tensile, or modulus values, it was suggested that competitive materials not be compared until black loading, polymer Mooney, and oil extender level and type are all equivalent.

Quality was suggested as being the final determining factor. The masterbatch advantages of cleanliness, storage, and processing are to be discounted if quality is not at least equal to that of a good dry mix. Wear test results showing today's dispersant-type masterbatch as equivalent to dry-mix compounds were shown, and it was suggested that further improvements of these masterbatches will be forthcoming in the future.

"Production of Non-Dispersant-Type Black Masterbatches" by M. E. Samuels, Copolymer Rubber & Chemical Corp., covered this method of masterbatch production. In a short history section the ups and downs of the masterbatch production curve were given and partly explained. From a start in 1944 the black masterbatches crept up to 14% of the SBR production in 1952, but fell off to 7% in 1957. Among several suggestions for this loss are the advent of oil-extended polymers, adequate dry mixing capacity in consumer plants, and the opinion of many that black masterbatches lacked quality.

It was suggested that some quality deficiencies of black masterbatches may be due to the use of chemical dispersing agents such as ligno sulfonates; the theory is that these dispersants prevent rubber-to-black bonding during subsequent processing and vulcanization. A major problem is, however, that a non-dispersant process would have to be of the continuous rather than batch type.

In the early development work with the non-dispersant process, the carbon black grinding attempts did not produce a satisfactory method. Excessive wear on the grinding plates of the machines used was a deficiency with every material tried. Trials with chemical dispersants other than ligno sulfonates also proved futile. The breakthrough came with the discovery by Copolymer of a means of grinding and dispersing the carbon black in a steam jet syphon, a small device containing no working parts.

Also, Columbian Carbon Co. came up with its mechanical disperser utilizing high energy hydraulic shear. Both methods are used today. The Copolymer steam jet, however, was not completely satisfactory since carbon black was lost in the affluent. The design of new equipment to utilize the basic efficiency of the steam method was undertaken and the use of fluid energy pulverizers was finally arrived at, and the process is now covered by pending patent applications. The Columbian Carbon mechanical method, also patented, was announced in 1957, and the Copolymer method was installed for full-scale production in 1958. With a promise of superior tread wear for tires made from such masterbatches, these two methods have revived interest in black masterbatches, and predictions now are being made that they will surpass the growth of oil masterbatches.

The Copolymer or *dry* method consists of taking dry beaded carbon black and grinding to the smallest possible size in the fluid energy pulverizer and then introducing into water to form a dispersion. The *wet* process takes preslurried carbon black in water and reduces the black particle size by the Columbian mechanical disperser, a Mikropulverizer, a colloid mill, or combination of these. In either the wet or dry method the carbon black slurry, extender or process oil if used, and latex are accurately and continuously metered into a common stream and blended. This blend is known as carbex. This carbex is coagulated and finished as in normal SBR production except that no salt is needed for coagulation.

Work is continuing on other methods of producing black masterbatch including one by J. M. Huber Corp., which is reported to introduce the black into the latex stream without dispersing it in water. All these processes are covered by various stages of patent applications so that little has been published beyond the basic steps outlined in Dr. Samuels' paper.

Some of the problems and advantages of non-dispersant masterbatches are common to both wet and dry production methods. Advantages include elimination of the need of large storage tanks and the shorter period of water contact which is suggested as being less deleterious to the carbon

TABLE 1. COMMERCIALLY PRODUCED NON-DISPERSANT SBR BLACK MASTERBATCHES

Base Polymer	Black		Process Oil		Extender Oil		Producers and Production Code Numbers
	phr	Type	phr	Type	phr	Type	
1500	50	HAF	—	—	—	—	b-9199, f-8150, e-1600
1500	52	HAF	10	HA	—	—	a-3750, b-9153, c-4655, d-6661, e-number unknown
1500	55	HAF	10	HP	—	—	c-4650
1500	62.5	HAF	12	HP	—	—	c-4651
1500	52	ISAF	12.5	HA	—	—	a-3752, b-9154
1500	52	ISAF	10	HP	—	—	c-4654
1500	40	SAF	5	HA	—	—	b-9152
1706	50	HAF	—	—	25	HA	f-8250
1712	60	HAF	14	HA	37.5	HA	e-number unknown
1712	75	HAF	—	—	37.5	HA	a-3751, c-4750, d-6620, f-8254
1712	75	HAF	7.5	HA	37.5	HA	b-9275
1712	75	HAF	12.5	HA	37.5	HA	a-3757, c-4753, d-6682
1708	75	HAF	—	—	37.5	N	c-1805
1712	60	ISAF	—	—	37.5	HA	a-3753, b-9251
1712	60	ISAF	—	—	37.5	A	a-3759
1712	70	ISAF	7.5	HA	37.5	HA	b-9250
1712	75	ISAF	—	—	37.5	HA	c-4752
1711	75	ISAF	—	—	37.5	HA	f-8266
1712	75	ISAF	12.5	HA	37.5	HA	a-3758
1502	52	FEF	12.5	HA	—	—	a-3754
1707	60	FEF	—	—	37.5	N	f-8253
1778	75	FEF	12.5	N	37.5	N	a-3755
4700	100	FEF	—	—	50	HA	c-4751
1500	75	SRF	17.5	HA	—	—	a-3756
1501	150	MT	—	—	—	—	c-4652

NOTE: A—aromatic oil; HA—highly aromatic oil; HP—heavy process oil; and N—naphthenic oil.

PRODUCERS

a—Copolymer Rubber & Chemical Corp. (Carbomix).
b—General Tire & Rubber Co. (Gentro-Jet).
c—Goodrich-Gulf Chemicals, Inc. (Ameripol).
d—Phillips Chemical Co. (Philprene-Philjet).
e—Shell Chemical Co. ("OB" or "S").
f—Texas-U.S. Chemical Co. (Synpol).

black. The exclusion of salt from the process yields a material with less ash and lower soluble material content. Common problems include the need of precise control of the continuous process and lack of opportunity to analyze batches of black dispersions. Special controls and tests, however, have been devised for both versions of the non-dispersant process.

A problem inherent to all types of black masterbatch production is that of keeping the volatile matter and moisture concentration down to a minimum. Automatic instrumentation has been developed to examine the bales for moisture as they are produced.

Advantages claimed for the end-user are the economic advantage of reducing and simplifying the number of mixing and process operations in his plant. The attractive price of black masterbatches is due to the quantities of black and oil purchased by the producer which give him a lower material cost. Also, the charge made for the black mixing in these masterbatches is barely enough to cover actual production costs and is certainly less than a Banbury dry mixing charge.

This speaker further claimed that the quality of the dispersant-free black masterbatches is better than that of a dry mix although he admitted that the base polymer will determine to a great degree the properties of the masterbatch. He suggested that factory mixed masterbatch stocks will show greater property increases than laboratory stocks over dry mix stocks and that on an overall basis power consumption will be lower and mixing times shortened. Mooney viscosity is somewhat lower for the masterbatch stocks.

While the greatest use of black masterbatches has been in tires, and thus the properties and quality advantages are mainly expressed in terms of tire use, there are many uses for these masterbatches in non-tire applications. In tires there have been claims of up to 50% improvement in tread wear for tread stocks using ISAF black masterbatches. The speaker suggested that although the maximum improvement would not always be reached in every case, a good average tread wear improvement in the neighborhood of 8% to 10% can be shown regularly. The excellent black dispersion obtained with these masterbatches has made possible for the first time greater utilization of the higher reinforcing ISAF and SAF blacks, it was said.

A listing of the presently produced black masterbatches was included in the talk and is presented here (Table 1). Dr. Samuels pointed out that there are some of these that vary only slightly from each other and made a plea for an effort to standardize on fewer masterbatches before the detrimental effects of this large variety cause hardship on producer and consumer alike.

TABLE 2. POWER CONSUMPTION COMPARSION OF MASTERBATCH AND DRY MIX IN BANBURY

Stock	#1	#2	#3	#4	#5
Type of mix	Black MB	Black MB	dry mix	Black MB	dry mix
First stage, rpm.	20	20	20	40	40
Second stage, rpm.	—	20	20	20	20
Total Banbury time, min.	6.5	7.5	10.5	5	6.5
Power peak, first stage, KVA	244	208	256	448	528
Second stage, KVA	—	280	272	264	264
Total power/1000 lbs., KWH	31.26	44.87	44.89	45.19	66.53
Williams plasticity	3.56	3.35	3.46	3.40	3.52
Recovery	.33	.29	.23	.30	.25
Visual dispersion rating	good	good	good	good	good
Mooney plasticity	62	55	57	57	60

"The Use of Black Masterbatches in Compounding" by Ralph T. LaPorte, Seiberling Rubber Co., was the final paper on the black masterbatch panel session. He attacked the problem by posing several questions:

"What will black masterbatch do for me in the plant and in my product?"

"Will it cost more money?"

"Can I maintain or improve quality?"

While these are fairly simple questions, the answers are far from easy to come by. According to LaPorte the cost consideration, for example, can easily take into account material cost, handling and transportation costs, black bonus, etc., but the unexpected advantages may be the factors which finally tip the balance one way or the other. Some of these unexpected bonuses are, for instance, improved appearance in storage area, less dirt in other than mill room areas, improved employe morale, shorter mixing cycles than figured, improvement in tuber efficiency, and improved uniformity of physical properties. He suggested, therefore, that even if a present analysis of the value of masterbatch in a plant is borderline, a trial of sufficient volume should be run to evaluate these unknowns.

An example cited is that of factory mixing cycle time reduction with black masterbatches. Pretrial analysis predicted a shorter mixing time, but did not begin to suggest that the time would be reduced the 40% that was eventually realized. Another unexpected bonus appeared in the factory tubing operation where off-spec tread was reduced 50%. Where the operation had been running 25 to 30% returned stock for reprocessing at the tuber with dry mix, the use of masterbatch reduced this figure to about 12%. Since the same machines and personnel were used, this result was hard to explain.

A knowledge of basic compounding technology easily solves the problems involved in substituting the masterbatch for a dry mix stock. If like rubbers and blacks are substituted through use of a masterbatch, only slight adjustment of other ingredients, chiefly oils, is needed to bring the compound to close approximation if not exact duplicate of the original formula. The mixing step, of course, is difficult to predetermine. Since the black is already in the rubber, the temperature characteristics of a masterbatch mix are different, and cycles have to be set up with this thought in mind to get full benefits of the shorter mixing times.

Speaking of quality, LaPorte made the following statement:

"Tread stocks made from commercially available black masterbatches and compared directly with a like formulation by the conventional dry mix method of processing, consistently show improved resistance to fatigue cracking and show equal or better tread wear."

This statement is purposely conservative regarding wear properties since although improvement of up to 30% has been recorded, there are other instances where losses of 5% to 10% have been found. From the running of many comparative tests it is suggested that an average improvement of 5% to 7% could be claimed for the masterbatch tread stocks.

A final portion of the paper was devoted to a power consumption study comparing a black masterbatch mix with a dry black mix. The two compounds were designed to be equal in rubber, black, and oil content with the totals being: SBR 1500 polymer—50, SBR 1712 polymer—50, total oil — 23.80, and total black 45.25 based on RHC plus oil. The results of this study are presented in Table 2. Comparisons were made with Banbury running at 20 rpm. for single-stage mix, two-stage mix with both stages at 20 rpm., and two-stage mix with first-stage 40 rpm. and second stage 20 rpm.

High-Speed Vulcanization Symposium

The second technical session held on June 6 was concerned with the newest developments in high-speed vulcanization. Three methods were described for accomplishing this which included high-frequency methods, CV curing, and liquid metal curing. Moderator for this panel was C. A. Frederickson, Southern Electrical Corp.

"Vulcanization by High-Frequency Methods," by B. B. Boonstra, Godfrey L. Cabot, Inc., was the first paper of

Fig. 2. Panel on high-speed vulcanization: *(left to right)* C. A. Frederickson (moderator), B. B. Boonstra, M. A. Schoenbeck, and D. B. Cofer

this symposium. The use of a condenser or capacitor to produce vulcanization or cross-linking was discussed. Two parallel plates with an alternating voltage imposed on them will cause the dipoles in an insulating material such as a rubber compound, when placed between them to orient in the direction of the field, and since the field is alternating, the dipoles will follow, with the result that heat is produced for vulcanization.

This method heats completely through the material at once, in contrast to heating from the surface inward; thus the poor heat transfer rate of most polymeric materials that hinders cure in the interior of large parts is no longer a problem. A deficiency in many cases, however, is that while heat is developed all through the compound, it may not be generated uniformly if the material is not (electrically) uniform. Local concentrations of fillers, for example, may produce serious cold spots or hot spots, blisters, charring, arcing, or burning.

With the most common rubbers, certain problems must be overcome to use dielectric heating. Natural rubber, SBR, butyl, and polyethylene, without fillers, have too low a loss factor to be heated efficiently. Nitrile rubber, neoprene, and phenolformaldehyde have much more favorable power factors. By proper compounding, however, the use of fillers such as carbon black will change the power factors of the first group of polymers and allow the use of dielectric heating in many cases.

Some conclusions reached in this study were that for the general-purpose rubbers, much research may be needed in each specific case to find the proper formulation; nitrile rubbers have the necessary requirements for successful dielectric heating, and neoprene may also at frequencies below 5 Mc.; at present, dielectric heating finds its greatest use in preheating thick sections of phenolformaldehyde compounds and in curing the resin bond in plywood manufacture. A relatively new application, being pioneered by the speaker, is cross-linking of carbon black-loaded polyethylene with an organic peroxide. A very important point, when working with new compounds, is to determine their dielectric characteristics and their temperature functions before going into production.

"Continuous Vulcanization," by D. B. Cofer, Southwire Co., was the second paper on high-speed curing. This paper covered quite fully many of the newer innovations in CV curing for wire and cable, with considerable emphasis on the "room temperature process" being used in many plants today.

This speaker suggested that most of these developments have centered around three aspects of the CV process: (1) improved flow and working characteristics of the screw and head, (2) methods to reduce scuffing or dragging of the uncured compound in the steam tube, and (3) faster and safer curing systems. Some of the ways these problems have been attacked are through machinery development such as special screw designs, screen packs between screw and head, vertical steam tubes in multi-story buildings, steam tubes with catinary curve to reduce drag, improved heating and cooling control, and many others.

Control of heat history of the compounds is essential. The "room temperature" method where stock is mixed completely in the first step, cooled immediately after mixing, and fed to the extruder at room temperature is one attack on this problem. Another method has been developed where the acceleration is added on the warm-up mill and fed directly into the extruder. These two methods provide practical ways to increase efficiency and speed up extrusions, but the conclusions drawn by the speaker pointed out very clearly that in continuous vulcanization (CV) curing by any method, the most important feature is effective control of all phases of the operation.

"Liquid Metal Curing,"[2] by M. A. Schoenbeck, Du Pont, provides a look at the method developed to permit continuous vulcanization of many other types of extrusions besides wire and cable. The most important gain obtained with this method is reduced amount of handling of the extrusion with consequent reduction in waste, cost, and space requirements.

The major problem that had to be licked to produce good continuously vulcanized extrusions was the elimination of entrapped gases which caused porosity. This problem has been solved by two methods. The first was the use of proper compounding to yield stocks with plasticities that would give the desired results. This approach was somewhat restrictive, however; so the second development became very important. The development of an extruder which will remove the air during the extrusion process is the key to the success of the system. For maximum utilization of this liquid medium curing (LCM) method a vacuum-type extruder is essential. The vacuum may be pulled through the screw or through the wall, but at the moment, the vacuum-through-the-screw version appears to be more effective. This type of vacuum extruder has been patented and is covered by United States patent No. 2,774,105, assigned to Du Pont.

The remainder of the system consists of precoaters to dust or oil coat the extrusion before it goes into the curing tank where molten metal or heat-stable organic liquids provide intimate contact with the extrusion. The speaker described quite fully the equipment used in the system, some of the compounding ideas to utilize the method with or without a vacuum extruder, and some of the applications well suited to this type of curing.

[2] Rubber World, Apr., 1958, p. 81.

Fig. 3. Newly elected officers of the Southern Rubber Group: *(left to right)* Roger Pfau, vice chairman, Ed Strube, secretary, Charles White, director, M. Samuels, director, Eldon Ruch, chairman, and W. Hall, director

IRC Abstracts on Reinforcement, Vulcanization; Registration Slow

Another group of abstracts of papers to be presented at the International Rubber Conference in Washington, D. C., November 9-13, is presented in this issue. These abstracts cover papers on elastomer reinforcement, natural rubber and latex, and vulcanization. Abstracts of other papers were published in our July and August issues.

Reprints of all of the 75 papers will be available to registrants at the time of the Conference and will represent the only publication of all of the complete papers at this time in one volume. Many of the papers may be published after the Conference in the journals of the sponsoring societies or elsewhere, but only individually or in small groups.

Based on an advance room registration at the Shoreham and Sheraton-Park hotels of more than 1,000, the local committee on arrangements headed by A. W. Sloan, Atlantic Research Corp., is anticipating a large attendance at the Conference. Actual preregistration with the Conference committee was less than 200 in mid-August, however, and more preregistration of this sort would help the local committee greatly in reducing congestion at the registration desks at the time of the meeting.

The Conference committee in late July decided that the exhibit of testing equipment at the Shoreham Hotel would be extended to include exhibits of rubber products, chemicals and compounding ingredients, and processing machinery and equipment. It is expected that an outstanding group of exhibits of very great interest to those attending the Conference will develop. Interested exhibitors should contact Norman Bekkedahl, exhibit chairman, National Bureau of Standards, Washington 25, D. C., EMerson 2-4040, extension 7070.

The last group of abstracts will appear in our October issue together with a final corrected program of all the papers to be presented and other last-minute information.

International Rubber Conference Program *(Continued)*

Session No. 7—Thursday Morning, November 12

Elastomer Reinforcement

40. Reinforcement of Rubber by Fillers. E. Andrews, L. Mullins, and N. R. Tobin, BRPRA.

The relative adhesion between rubber and fillers is examined in an electron-microscope study of ruptured surfaces, and the effect of dispersion procedures and promoters described. It is shown that rupture of rubber vulcanizates occurs preferentially at the interface between rubber and filler particles. One source of the increase in strength which results from the incorporation of reinforcing fillers is traced to the resultant multiple breakdown at the surface of filler particles. This breakdown involves a dissipation of energy and results in a roughening of the ruptured surfaces.

Two other important characteristics of filler reinforced rubbers, *viz.*—their large hysteresis and their softening during stretching, are examined in light of these observations, and a consistent picture of the role of fillers in reinforcement is proposed.

41. Elastomer-Filler Interactions. J. P. Berry, P. J. Cayre, and M. Morton, University of Akron.

It has been found by several investigators in recent years that either cold milling or heating of carbon black-rubber mixtures results in the formation of some "bound rubber" or "carbon gel." There is evidence that free radicals are involved in these processes.

New data have been obtained which show that heating milled carbon black-SBR mixtures, at vulcanization temperatures, results in an increase both in bound rubber and in degree of cross-linking, especially the latter. This effect of heating after milling is much larger than either milling or heating alone. There are indications that the free radicals formed during the milling are more or less "frozen" by the high viscosity of the matrix, but react quickly at higher temperature to add more bound rubber, and especially to cross-link the bound rubber about ten times more than either of the separate treatments.

It was found, however, that the degree of cross-linking introduced by sulfur vulcanization, in presence of an HAF black, is about ten times as great as that produced by milling and heating alone. Hence the carbon black-rubber interaction *per se* does not contribute much to the number of cross-links in the vulcanizate. It should be noted, however, that the cross-links introduced by sulfur vulcanization and by milling black-rubber mixtures are additive.

Some correlations are shown between stress-strain behavior and the proportion of cross-links due to black-rubber interaction.

42. Interactions of Hydrocarbons and Powers. W. A. Wake, RABRM.

This paper is implicitly concerned with the reinforcement of rubber and the difference between various powders in their reinforcing effect. Hydrocarbons of low molecular weight have been used as models for rubber and the energy of adsorption onto a range of powders has been considered.

The powders, carbon black, silica, barytes, and whiting, show a range of adsorptive behavior due to their neutral or ionic crystal structure interacting with the polarization properties of the liquids used. The results have been obtained by direct wetting and refer to the integral heat of adsorption. It is quite clearly shown that, for unit surface area, the total energy of adsorption of a liquid containing a polarizable double bond is far higher onto an ionic crystal such as barytes than it is onto carbon black, so that if high adhesion of the liquid to the powder were an important factor in reinforcement, ionic powders would be desirable.

Part of the paper considers the differentiation of the mobile from the localized (Langmuir) model of adsorption. The available data enable entropy calculations to be made for certain hydrocarbons adsorbed onto carbon black. The calculated entropy change agrees well with that predicted by theoretical calculation for mobile rather than localized site absorption. These results together with the total energies, suggest the superiority of carbon black is associated not only with its ability to accept free radicals, as has been pointed out elsewhere, but also with the relatively low total energy of adsorption permitting the adsorbed molecule to retain mobility on the surface.

43. Mechanico-Chemical Reactions Leading to Reinforcement in Rubbers. R. J. Ceresa, National College of Rubber Technology, London, England.

A short survey of the polymeric free radical processes induced by the mastication of (1) rubbers with carbon black, (2) mixtures of rubbers, and (3) rubbers swollen with free radical polymerizable olefinic monomers, will be presented.

The interaction of ionic materials of the general structure MX_n, e.g., aluminum isopropoxide, with rubbers during mastication to give cross-linking and consequent gel content is included. The postulation of an ionic mechanism to account for the cross-linking which is further extended to cover the mechanism of reinforcement of rubbers by phenolic resins, epoxy resins, and gelation in rubbers with other additives during mastication, will be described.

Physical testing data will illustrate the reinforcing effect of gelation prior to vulcanization.

44. Oxidation of *Hevea* Vulcanizates Containing Carbon Black. E. M. Bevilacqua, U. S. Rubber, Wayne.

The detailed investigation of the mechanism of degradation of polyisoprene by oxygen has now been ex-

tended to a study of the effect of carbon black. Since previous work has shown that the mechanism is not affected by the nature of the cross-link, a simple peroxide cure was used in the experiments described in this report. It is found that all of the low molecular weight products known to be an index of hydrocarbon scission reactions are formed in a stock containing 50 parts of MPC black. The ratios of the quantities of these products and to oxygen consumed are identical within experimental error with those observed for rubber containing no carbon black, whether vulcanized or not. From this evidence it can be concluded that carbon black has no effect on the overall mechanism of degradation of the polymer except on rate.

It appears possible to explain the effect of carbon black on the rate of degradation of the polymer by oxygen by assuming simply that it is a moderately good thermal antioxidant.

Upon comparison of the results of swelling and solubility measurements with the conclusions from the chemical evidence concerning the degradation reaction, it appears that a way has been achieved to make an absolute calibration of cross-link density in a network containing carbon black.

45. Swell Resistance of Polymer Filler Systems to Boiling Water. S. Palinchak and W. J. Mueller, Battelle Memorial Institute, Columbus, O.

Rubber vulcanizates used as gaskets, which will be exposed to steam, must be resistant to water at elevated temperatures if they are to function properly. Excessive water absorption results in a high degree of swelling and loss of physical properties. Data in the literature on water absorption and swelling of polymer-filler systems are very limited, with only a few publications dealing directly with this subject. Therefore, this study was undertaken as a means of systematically collecting and correlating data.

In the program, the swelling and the water absorption of a large variety of vulcanizates were determined in boiling water for exposure periods up to 168 hours. It was found that (1) the initial rate of water absorption, (2) the time required to reach equilibrium absorption, and (3) the maximum amount of water absorption were different for each polymer and were greatly affected by the filler used. Vulcanizates based on polymers such as Enjay Butyl 325 and SBR 1503 and filled with carbon black, Cab-O-Sil, and Calcene NC had low water absorption. Polar polymers, on the other hand, such as nitrile and neoprene, or fillers, such as magnesium oxide and Silene EF, gave vulcanizates which continued to swell even after 168 hours' exposure to boiling water.

This work indicates (1) polymer-filler systems which can be used for minimum swelling and water absorption in boiling water, (2) systems which must be carefully avoided for use with boiling water or steam, and (3) the theoretical aspects of the results and a possible approach for predicting water absorption characteristics for various polymer-filler systems.

46. Selection of Process and Extender Oils with Minimum Staining Characteristics for Use in Rubber. J. S. Sweely, J. B. Ziegler, R. W. King, and S. S. Kurtz, Jr., Sun Oil Co., Marcus Hook, Pa.

It has been shown by previous references (Borg *et al.*) that process oils low in aromatic content (less than 40% aromatic molecules) are desirable for use as plasticizers and extenders in light-colored rubber stocks. The present paper expresses the desirable range of aromatic content in terms of aromatic carbons rather than aromatic molecules since there is good reason to believe that this basis is more reliable for classifying oils for this use. Also carbon-type data cost less to obtain than molecular-type composition data. The aromatic part of the molecule is the part mainly concerned with light adsorption and, in general, with degradative processes.

A table of data is presented giving physical properties, molecular-type composition, and carbon-type composition for about 25 oils considered for use in light-colored rubber. A graph is presented showing the molecular weight and probable volatilities of those oils. Carbon-type composition is also presented graphically. Data show the relation between position on the carbon-type composition graph and the color stability in a quantitative light reflection test. These data indicate that preferred oils for non-staining use should have 6% or less aromatic carbons, although oils up to 16% aromatic carbons may be used for this type of application, when compatibility or processibility are considered important. Since the % aromatic carbons can be easily derived from simple physical property measurements, this system of selecting oils is suitable for use in practical compounding.

Data presented also compare indoor and outdoor exposure tests.

Session No. 8—Thursday Morning, November 12

Natural Rubber and Latex

47. Preservation of Natural Rubber Latex in the Field. J. S. Lowe, Dunlop Malayan Estates, Ltd., Batang, Malaka, Malaya.

It is now generally recognized that bacteria and bacterial enzymes are of great importance in controlling the properties of natural rubber latex concentrate and, in particular, in controlling the changes in properties that take place between the time of concentration in the tropics and consumption in the United States, United Kingdom, or elsewhere. Bacterial enzymes are of particular importance when one is dealing with large bulks of latex. A large bulk of latex will contain latex from a wide area and from a large number of clonal varieties, and effects attributable to these variables will be largely absent.

The addition of ammonia to latex suppresses the activity of the bacteria. In an earlier paper[1] the author described the conditions required to activate the bacterial enzymes present in the latex after concentration and the resulting alterations in the properties of the latex. These changes are normally followed by measuring the evolution of the volatile fatty acid content of the concentrate. The present paper describes the effect of different field conditions in influencing the number of bacteria in the concentrate and the evolution of its properties. This paper touches on such points as the fact that small quantities of ammonia encourage rather than suppress bacterial growth; the need of early collection of the latex and careful supervision of collection routines in the field. The effect of such factors as the density of the canopy of the rubber trees is also considered. A heavy canopy affects the temperature of the latex in the tapping cup and can, therefore, have a marked effect on the rate of bacterial proliferation prior to collection. The bacterial activity is also controlled by the amount of substrate present. The practical implications of this point in regard to latex processing are discussed.

48. Modern Large-Scale Production of *Hevea* Rubber. G. Verhaar, Firestone Plantations Co., Harbel, Liberia.

The Firestone plantations in Liberia cover 71,000 acres of producing rubber and 15,000 acres of immature rubber. Annual production is now at the rate of 85 million pounds; in addition, more than 11 million pounds of locally purchased rubber are processed and shipped. The Harbel area is the largest continuous plantation unit in the world. At present, eleven different grades of rubber are produced including a "tailor-made" rubber with high physical properties.

First-quality crepe is produced by blending sulfited field latex in lots of 7,000 gallons, coagulating in 175-gallon lots in moving containers while in transit over mono-rail system to the milling station, milling, and drying at 110° F.

The rubber produced from ammoniated centrifuge skim is chemically purified. The process consists of clarifying the skim to remove copper, allowing the skim to coagulate sponta-

[1] RUBBER WORLD, July, 1958, p. 584.

neously, milling it to a crumb, treating it successively with saturated lime water and a caustic solution, followed by a thorough rinsing. This gives a clean, bright-colored, sweet smelling dry rubber with a nitrogen content, acetone extract, ash and rate of cure only slightly higher than those of regular first-quality pale crepe.

49. Recent Developments in the Production and Processing of Natural Rubber in Malaya. J. E. Morris and B. C. Sekhar, Rubber Research Institute of Malaya, Kuala Lumpur, Malaya.

The past decade has brought many changes in the Malayan rubber industry and has been characterized by vigorous replanting, maximum economic exploitation of estates and smallholdings, and developments of new forms of natural rubber.

The differences between latex and dry rubber obtained from young and old, clonal and seedling trees are presented along with results of normal tapping compared with the newer high intensity tapping, high level tapping, and tapping with the use of yield stimulants. The general effects of these changes on the properties of Malayan rubbers are discussed.

The main contaminants of natural rubber are described together with results from experiments designed to give improved quality rubbers.

Removal of certain non-rubbers from natural rubber or modification of the non-rubbers has given commercially valuable products. Details of these processes are presented, particularly in respect to the preparation of purified crepe and the production of Technically Classified rubbers.

Field latex variation has its effect on the production of latex concentrates and especially on low ammonia preserved types. Examples are given of the recent commercial developments of low ammonia latices which now constitute an appreciable and increasing proportion of the latex concentrate produced.

Production of the recently developed Superior Processing rubbers in the form of crepe, air-dried sheet, and Ribbed Smoked Sheet has reached 2,000 tons per annum. A new low-grade type known as SP Brown and a versatile processing aid known as SP-90 are also described.

Details of recent work on latex which may well influence commercial processing in the future are given. In particular, the mechanism of rubber oxidation during processing and storage and the possibilities of combating such deterioration are suggested. Variation in oxygen reactivity of the polyisoprene contained in different clonal field latices is described.

The presence of reactive "amine"-type reduction activators has been established in field latices. These give a new insight into some of the problems of pale crepe production. Owing to the reactivity of the rubber in fresh field latex and the presence of reactive substances the properties of modified rubbers prepared from them are substantially different from those prepared from preserved latex. This point is discussed with particular reference to thiol acid rubbers and graft rubbers.

50. Standardization of Natural Rubber—Present Trends. M. Liponski and Vu-Dinh-Do, Rubber Research Institute of Viet-Nam.

Coagulation in partitioned tanks, still the general practice on plantations, causes variability in the mechanical properties of the rubber of which the prevailing commercial classifications, based solely on appearance, give no clear indication. Consequently a first effort was made to put on the market rubbers technically classified on the basis of their vulcanizing characteristics (TCR—Technically Classified rubber).

If it is desired to adapt coagulation conditions to the different types of latices so as to produce a rubber with constant vulcanization characteristics, it is found that at times this technical improvement cannot be achieved without detriment to outward appearance —which shows how irrational present commercial grading is.

To insure proper manufacture, it has proved necessary to change the coagulation method radically to insure preparation of a product which would be judged only by technological standards, as, for that matter, synthetic rubber is.

The production of two types has thus been developed on pilot-plant scale:

C 57 Standard, with the properties of smoked or dried sheet, corresponds to blue circle TCR and is obtained by a continuous process involving controlled, automatic acidification, thermo-coagulation, and granulation of the coagulum.

F 58 Standard, which looks like a very pale crepe, is made by a flocculation process which also permits continuous operation.

These two processes not only make it possible to insure constant properties, but also to improve them, thanks to control of coagulation by means of the pH meter and more efficient adjustment of drying conditions.

51. Physiology as a Help to Improvement of Yields of *Hevea*. J. Le Bras, Institut Français du Caoutchouc.

This paper presents a general outline of the research carried out at the Rubber Research Institute in Indo-China, aimed at a better understanding of certain physiological factors which affect the yield of *Hevea* rubbers.

The starting point was the hypothesis that a part of the substances which it is assumed insure the biosynthesis of rubber, is more or less carried along in the flow of latex; the cells therefore have to synthesize these substances after each tapping; and the materials in danger of being most deficient for this reconstitution—if the plant is adequately provided with nitrogen, phosphorus, and potassium—are oligo-elements. This led to a first experimental project based on the direct introduction into the tree, by injection into the wood, of products whose action it was desired to study. The most active proved to be copper salts, especially the sulfate, injection of which resulted in a marked increase in latex secretion from *Hevea* rubbers under normal conditions of exploitation, and that for two or three months.

Then research was extended to the principal mineral elements utilized by the plants and their variations in leaves and in the latex during the year and in relation to the plant material. After thousands of samples had been analyzed, certain laws emerged which govern the mineral metabolism of *Hevea* and to deduce from them the equilibria which must be insured in order that the assimilation and utilization of these elements may take place under the best conditions. In this way, what is called the "physiological diagnosis" can be established for a planting material, making it possible to plan a more rational exploitation of *Hevea* rubber and to insure optimum output by determining the most suitable fertilizers and injections. This method is now being used successfully by the leading plantations in Viet-Nam and Cambodia.

Session No. 9—Thursday Afternoon, November 12

Vulcanization

52. Properties of Compounds Relative to Vulcanization. J. H. Gifford, Witco Chemical Co., Akron.

A study of tread-type compounds indicates a definite relation exists between free sulfur and state of cure as measured by optimum physical properties.

For smoked sheet tread compounds, this relation falls on the hyperbolic curve with formula: $625\ (0.6 - \text{Free Sulfur})^2 - 0.02\ (280 - T)^2 = 1$, where T is degrees Fahrenheit.

For the SBR 1500 tread compound, the relation is a parabolic curve with formula: $0.04\ (T - 303)^2 - 1100\ (\text{Free Sulfur} - 0.15) = 0$, with T the temperature in degrees Fahrenheit.

For a tread composed of 80% smoke sheets and 20% SBR 1500, free sulfur for vulcanizates of optimum physical properties, except for heat build-up, appears to be about 0.3% for all vulcanizing temperatures. Minimum heat build-up of the 80-20 blend occurs at the minimum free sulfur point at 260° F. cure temperature in contrast

to the smoked sheet compound where the minimum heat build-up occurs at the maximum free sulfur point at about the same temperature.

This study indicates that the practice of approximating equivalent cures by doubling the time for each 18° F. decrease in vulcanizing temperature is grossly inaccurate.

The data show that for smoked sheet tread, time and temperature are related as follows: 220 Log Log Time + Temp. °F. = 326. For SBR 1500 tread, the relation is 70 Log Time + Temp. °F. = 432, and for the 80% smoked sheet and 20% SBR 1500 tread, the relation is 60 Log Time + Temp. °F. = 400.

Examination of data shows a progressive decrease in optimum physical properties of smoked sheet tread as vulcanizing temperatures are raised above 260° F. For SBR 1500 tread, optimum physical properties are not affected as vulcanizing temperatures vary from 240 to 340° F.

The 80% smoked sheets—20% SBR 1500 tread reacts differently from both smoked sheets and SBR 1500 tread compounds. At high vulcanizing temperatures, there is only slight loss in tensile, but loss in modulus is almost twice that of smoked sheets tread. There is no change of heat build-up properties at high vulcanizing temperatures, which is in contrast to an appreciable increase of heat build-up properties of smoked sheets tread as vulcanizing temperature is increased.

It is suggested that in conjunction with thermocouple data, the above free sulfur-vulcanizing temperature relations can be used to measure the state of cure of a tire tread.

53. Estimation of the State of Cure of Elastomers by Means of Radioactive Sulfur. H. L. Pederson, Nordiske Kabel-OG Traadfabriker, Copenhagen, Denmark.

The introduction of radioactive sulfur (S-35) having a specific activity of 0.2-0.4 mC/g. followed by an exhaustive extraction with acetone permits the determination of bound sulfur calculated as the ratio of the activities of the sample before and after extraction.

Using a one-inch circular disk, 0.8-mm. thick, the "apparent bound sulfur" can be determined with a standard deviation of about 5%. The method is of special value when used with polymers not easily dissolved in nitric acid such as neoprene, SBR, butyl, and nitrile rubbers.

According to Dogadkin, the labeled samples are treated with a benzene solution of sulfur (S-32), and the exchange of sulfur is determined as a decrease of the sample activity. Also investigated was the treatment with the solution of sulfur donors TMT and tetrone in acetone solution at the boiling point.

Finally, the reaction with methyl iodide (Meyer and Selker) has been studied by boiling another set of extracted samples in a 1:2 mixture of CH_3I: acetone.

For different curing times at constant temperatures using different polymers and curing systems a stability pattern for the sulfur bond is revealed which in turn is compared with the aging stability of the systems involved.

Owing to serious experimental difficulties, the results presented are preliminary and not quite consistent in all cases. The sulfur (S-32) exchange and the methyl iodide-thiuram reaction do not follow the same trend.

54. Chemical Interpretation of Dicumyl Peroxide Vulcanization. L. O. Amberg and W. D. Willis, Hercules Powder Co., Wilmington.

Dicumyl peroxide (α, α-dimethylbenzyl peroxide) thermally decomposes with the formation of free radicals. In certain environments it may decompose through an ionic cleavage reaction. The free radicals will vulcanize a variety of polymers; the cleavage products will not.

In neutral or alkaline environments, cumyloxy (α, α-dimethylbenzyloxy) radicals form by a temperature-dependent first-order reaction. These cumyloxy radicals abstract the more highly labile hydrogens from polymers to form cumyl alcohol. They also split out acetophenone, leaving more reactive methyl radicals which can abstract less active hydrogen atoms. The relative extent to which each reaction occurs depends on the polymer and environment. In the presence of acidic materials, these reactions are also accompanied by ionic cleavage of the peroxide.

Active sites created in polymer chains by removal of hydrogen atoms induce cross-linking by coupling with similar sites in other chains. Other materials used in rubber compounds, however, may also react with these free radicals or induce ionic cleavage and thus increase the amount of dicumyl peroxide required for vulcanization.

Data illustrate how the chemistry of dicumyl peroxide vulcanization affects the utility in cross-linking various polymers, and the selection of suitable fillers, plasticizers, antioxidants, antiozonants, and other materials.

The data presented also provide fundamental information which will allow the compounder to utilize the demonstrated and potential advantages of dicumyl peroxide vulcanization.

55. Chemistry of Vulcanization of "Viton" A Fluorocarbon Elastomer. John F. Smith, Du Pont.

Diamines, and the newer types of curing agents, are reviewed briefly. The curing action of tertiary amines and of dithiols are particularly discussed from the mechanistic point of view. Physical data (Relaxometer, resilience/cross-link density relations) are presented indicating that the process of cross-linking is complex, involving chain scission in addition to cross-link formation. Analogies are drawn to reversion and chain scission during the cure of other elastomers.

The action of amines on "Viton" A in solution is described showing differences between 1°, 2°, and 3° amines in degrees of HF split off. Infrared evidence is presented that unsaturated centers develop during the treatment and that incorporation of amine into the polymer chain occurs.

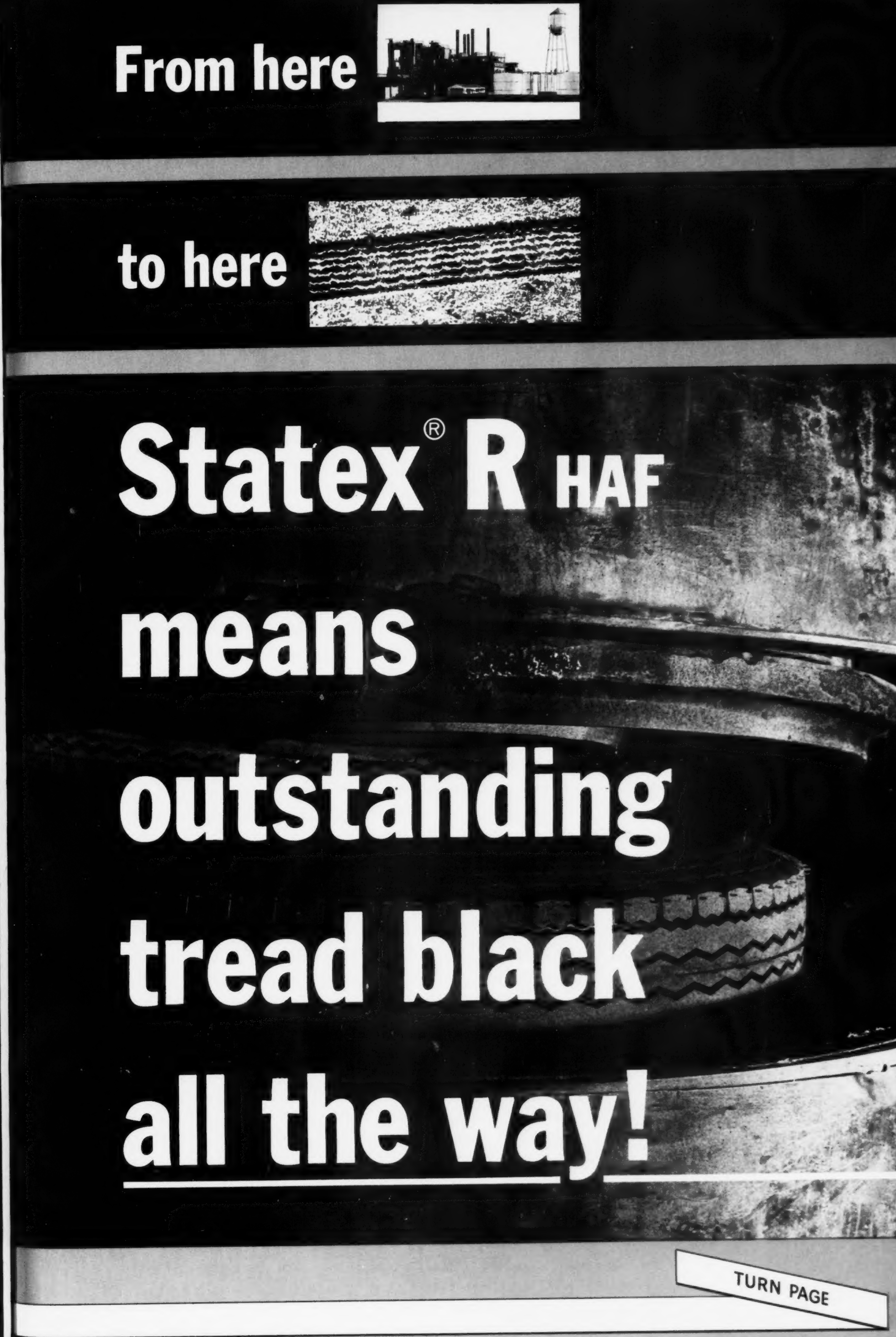
The action of peroxides and high energy radiation on "Viton" is described, showing from infrared spectra that HF elimination is involved and that some centers of heat instability are introduced which cause cross-link formation on further heating. The role of acid acceptors in the cure is discussed, and a mechanism for the curing reaction proposed.

56. Crystallization and Cure Studies of Neoprene W Using Dielectric Measurements. M. Hanok and I. N. Cooperman, New York Naval Shipyard, Brooklyn, N. Y.

A study of a Neoprene W compound in the elastomeric state was conducted to determine the usefulness of measurements of dielectric constant and dielectric loss in showing the extent of cure of this linear polar polymer and in following crystallization changes as a time-dependent phenomenon occurring in the elastomer in the unstressed state. The work was based on concepts that increased hindrance to rotation of the polar polymeric chains in an alternating electric field, either in the form of additional network cross-links or increased orientation of the polymer chain segments, would decrease the dielectric constant at a given frequency, and that vulcanizates in different states of cure should demonstrate differences in critical frequency and differences in dielectric loss and dielectric constant at the critical frequency.

A Neoprene W stock was cured at 290° F. at periods ranging from 30 to 200 minutes. Measurements of dielectric constant and dielectric loss were made on these vulcanizates at intervals ranging from one hour to 36 weeks after cure, at frequencies ranging from 50 to 75 megacycles, and at temperatures from 74° F. to temperatures above the melting temperatures of Neoprene W crystallites. Volume swell measurements in benzene were made to establish the degree of cross-linking. Stress-strain measurements were made to indicate the state of cure. X-ray diffraction diagrams were made to verify crystallization.

The results indicated differences in the cure of the experimental vulcan-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izates and showed sensitivity of the dielectric constants to crystallization and to changes in crystallization occurring with time after cure.

Rate constants for crystallization were calculated from the dielectric data and used to calculate the activation energy for crystallization from the Arrhenius equation. The Cole and Cole diagrams were examined for Debye theory adherence. The activation energies for relaxation in Neoprene W were compared with those of other polymers.

57. Investigation of Radical and Polar Mechanisms in Vulcanization Reactions. J. Reid Shelton and E. T. McDonel, Case Institute of Technology.

The fundamental nature of the mechanism of vulcanization of styrene-butadiene rubber has been investigated for a number of curing systems. Hydroquinone and other materials known to act as free-radical stoppers have been used to determine whether an ionic or free-radical mechanism is involved in each case. This is accomplished by observing the rate of formation of cross-links, as determined by swelling measurements, in each curing system with and without the free-radical scavenger.

The method has been tested with known systems and then applied to systems in which the mechanism was unknown. Thus the generally accepted free-radical nature of the mechanism involved in vulcanization with peroxides is confirmed by a decrease in rate of cross-link formation in the presence of free-radical stoppers. Similarly, the polar mechanism which has been proposed for a unaccelerated rubber-sulfur cure is confirmed by a small increase in rate of cross-link formation in the presence of hydroquinone, rather than a decrease. Many of the commonly used accelerated sulfur curing systems and accelerator curing systems without free sulfur have been investigated. The classification of each of these systems for vulcanizing styrene-butadiene rubber, according to whether the mechanism is predominantly polar or free radical as determined by this method, is presented in this paper.

58. Contrasts in the Response of Elastomers to High-Temperature Vulcanization. Frank B. Smith, Naugatuck Chemical Division, U. S. Rubber, Naugatuck, Conn.

Typical tread and carcass compounds of natural rubber, SBR, NBR, butyl, polychloroprene, and natural-SBR blends were vulcanized at temperatures from 292 to 500° F. Contrasts in the response of these elastomers to the higher vulcanizing temperatures were studied in terms of basic physical properties.

Within this curing range an increase in the vulcanization temperature exerted a deleterious effect on all polymers except resin cured butyl. The effect is most marked above 370° F. The magnitude of this effect, however, varies for each elastomer. Natural rubber reverts badly. In general, SBR and NBR show a superiority to *Hevea* at the higher curing temperatures. In these tests polychloroprene showed marked instability. Resin cured butyl showed flat curing and aging characteristics up to 500° F. curing temperature.

Certain implications of these results are summarized with respect to the selection of elastomers for high-temperature vulcanization applications.

(*To be continued*)

Record DRPG Outing

Scattered morning showers on June 26 failed to dampen the enthusiasm of a capacity crowd at the Detroit Rubber & Plastics Group annual golf outing at Western Golf & Country Club, Detroit, Mich. Some 450 members and guests joined to make this affair the latest in a series of successful summer ventures by the Group.

Of these, nearly 200 tested their skill on the plush Western course. Low gross honors went to A. L. Nevens; second low gross, to H. Macklin, Ford Motor Co. For net honors all scores were handicapped by the Calloway system, with H. Lademan taking top honors. Other golf prize winners were: second low net, A. Rosenstein; third low net, Jack Ross, Permalastic Products Co.; closest to pin on #9, T. Oszewski; second closest, K. E. Parker; longest drive, R. L. Kessler; second longest drive, Art Watkins; and high gross (tie), W. McConnell and Jerry Stephens.

Besides these golf prize winners, there were some 20 additional draw prizes for the golfers and some 50 additional draw prizes for dinner guests.

The only reported casualty of the outing was J. B. Porter, H. Muehlstein & Co., Inc., Chicago. Porter was the victim of a send-off explosion on the first tee in the bagrack at the rear of his electric cart. Minor arm injuries were treated promptly at considerable expense, but with no serious effect on Porter's game—he managed to shoot a stroke or two better than his normal performance. At the time of the incident all witnesses happened to be looking the other way, but teams of detectives are pursuing the case diligently. At last reports a prime suspect in the affair was reported to be Cameron Duff, Witco Chemical.

The arrangements committee consisted of: general chairman and golf chairman, R. W. Malcolmson, E. I. du Pont de Nemours & Co., Inc.; dinner chairmen, Phil Millard, Automotive Rubber Co., and Walt Wilson, R. T. Vanderbilt Co.; door prizes, W. F. Miller, Yale Rubber Co.; special golf events, Phil Millard; and entertainment, Bob Chilton, Permalastic Products Co.

NYRG Golf Outing

Approximately 300 members and guests of the New York Rubber Group attended the various functions at the Group's golf outing on August 4 at the Forsgate Country Club, Jamesburg, N. J. Luncheon, dinner, and the "19th" hole were well attended as well as the actual golf competition. Members on the committee for the tournament were B. A. Wilkes, Godfrey L. Cabot, chairman; C. J. Lewis, U. S. Rubber, vice chairman; D. H. McCondichie, Merck & Co., treasurer; F. Raba, Triangle Conduit & Cable Co.; Fred Cooke and R. DeTurk, Cooke Color & Chemical; C. A. Mackintosh, Westwood Chemicals; and P. Fullam, Du Pont.

Winner of the Nesbit Golf Cup for low gross for a member was Dick Stimets, United Carbon Co., who carded a 74. The non-member low gross winner was Herman Fritz, Du Pont, with a 79. Members who were runners up were Wes Curtis, Naugatuck Chemical, with 76, and Jim Wernersbach, Enjay, with 77. Non-member second low gross went to C. Basilone with 82, and third to Fred Kurtz with an 85.

Kickers handicap produced a five-way tie at 77 with Fred Kurtz, Jack Mills, R. E. Nippes, Columbia-Southern Chemical, John Pendergas, and Ed Finney, Pittsburgh Coke & Chemical, sharing the honors. A total of 32 of the day's contestants qualified for birdie prizes, with two of the group producing two each. Jack Moran came closest to the 12th green with a one foot 11-inch distance. Wes Curtis was second, with 4 feet, and Ken Crouse, J. M. Huber Corp., third with 6 feet 7 inches. The hole-in-one contest was won by George Emery, Naugatuck Chemical, who was three feet from the pin; J. Burkhard, Goodrich-Gulf Chemicals, was second at 5 feet 2 inches, and D. F. Behney, Harwick Standard Chemical Co., came in third at 6 feet.

The day was concluded with a roast-beef dinner under a tent on the front lawn of the Club, and the distribution of about 40 door prizes to lucky winners.

The Group chairman, R. B. Carroll, R. E. Carroll, Inc., announced that the next meeting would be held on October 16 at the Henry Hudson Hotel, New York, and would feature a technical program on butyl rubber.

D-24 Groups Report Results of Much Work on Carbon Black Test Methods

Four subcommittees and the main committee D-24 on Carbon Black of the American Society for Testing Materials met on June 25 at Atlantic City, N. J. during the annual ASTM meeting. Action taken included the adoption of two tentative test methods as standards without revision, the appointment of a new chairman for Subcommittee 4 on Nomenclature, and the formation of a new Subcommittee 7 on Specifications.

Standards Adopted

Letter ballots were circulated in May, 1959, which produced no negative votes for the adoption of the 1958 annual report and for the adoption of the two standards. Adopted as standards were: (1) Ash Content of Carbon Black (D 1506-57T) and (2) Heating Loss of Carbon Black (D 1509-57T). Other business of the committee included announcement by the chairman, N. P. Bekema, United States Rubber Co., of the appointment of J. H. Gifford, Witco Chemical Co., to replace J. A. Tallant, Phillips Chemical Co., as chairman of Subcommittee 4 on Nomenclature. Mr. Bekema also announced the formation of a new Subcommittee 7 on Specifications, with Mr. Gifford as chairman. This subcommittee with membership identical to a task group on specifications for carbon black established by Subcommittee 29 of ASTM Committee D-11 on Rubber will prevent any duplication of effort.

Subcommittee Reports

Subcommittee 1—Physical Testing. J. F. Svetlik, Phillips Chemical Co., chairman.

Final results of the round-robin testing program conducted with the Mass Pellet Strength Test apparatus were reported by the chairman of the task group, I. Drogin, United Carbon Co. The data proved to be not duplicable enough for the method to be adopted as a tentative, however, so that another program has been outlined with J. Middleton, Cabot, Pampa, Tex., as chairman. This new testing program will be conducted by companies in the Borger, Pampa, Amarillo area of Texas so that all personnel may be present while tests are run on equipment furnished by T. K. Cox, Western Electric Co. It is expected that this procedure will furnish reasons for the variations in the first set of tests.

It was proposed that the procedures for pour density and sieve residue be considered for advancement to standards in February, 1960, and the procedures for attrition, fines, and pellet size distribution be reviewed in February to see if they, also, should be advanced to standard.

Subcommittee 2—Chemical Tests. L. G. Mason, B. F. Goodrich Co., chairman.

After examination of results of the D-24 letter-ballot the subcommittee voted to promote the Ash (D 1506-57T) and Heating Loss (D 1509-57T) test methods to standards. A subcommittee letter-ballot on Method of Test for pH Value of Carbon Black (D 1512-57T) showed no negative votes, but there was one request for the use of an aluminum beaker or dish. Majority opinion was that no untried piece of apparatus should be added. Action on Methods of Test for Sulfur Content of Carbon Black (D 1619-58T) and Method of Test for Volatile Content of Carbon Black (D 1620-58T) was postponed for one year.

Considerable time was spent on consideration of changes and modifications of Method of Test for Iodine Adsorption Number of Carbon Black (D 1510-57T). The results of two different groups working on this test were presented and discussed. It was the majority opinion, however, that the original D 1510-57T should be retained, or that any changes made should only be those that would shorten the time of operation of the test rather than alter the basic test. The task group under F. Lyon, Columbian Carbon Co., will continue to work in order to improve this test method.

Subcommittee 3—Optical Tests. John E. Smith, J. M. Huber Corp., chairman.

A report was made by A. E. Hicks, General Tire & Rubber Co., on work done studying the Method of Test for Discoloration of Benzene by Carbon Black (D1618-58T) by his task group. This group has been working on this method for more than a year and has tried to obtain reasons for the variations reported between laboratories at the subcommittee meeting in February, 1959. These discrepancies were found to be in the equipment and not considered serious.

The group made several recommendations for including cold extract method in the test, expanding the scope of both hot and cold extract methods, reduce boiling requirement to near boiling to eliminate bumping, and to modify the method to indicate absorbance instead of % optical transmission. The discussion produced several divergent views, however, particularly on the need of two procedures, the problem of correlation with stain being studied in a D-11 subcommittee, and the option or lack of option of the use of chloroform instead of benzene in the method. Final action was to postpone further consideration of the task group recommendations until the results of the D-11 subcommittee task group study on staining or "bleeding" methods versus this benzene (or chloroform) discoloration method are available.

Subcommittee 5—Sampling. Ralph Treat, Huber, chairman.

The task group on a sampling plan for packaged carbon black, with Dr. Drogin chairman, presented its rough draft for a tentative method. It was approved for submission to Committee D-24 for letter-ballot. The group on bulk shipment sampling reported that it expects to have data assembled and analyzed for action at the February, 1960, meeting. The resignation from D-24 of Mr. Tallant, who was chairman of this group, made a new chairman necessary. R. S. Hanmer, Phillips, stated that he or a coworker would accept the chairmanship vacated by Mr. Tallant.

Chicago Golf Outing

A record annual golf outing of the Chicago Rubber Group was held July 24 at the St. Andrews Country Club, near Chicago, Ill. More than 410 members and guests played golf or attended the dinner. Golf and door prizes worth $4,700 retail were distributed by the committee, who expressed appreciation to more than 150 rubber manufacturers and raw material suppliers for their contributions to this affair.

Harold Shetler, Chicago Rawhide Mfg. Co., committee chairman, was assisted by Harold Stark, Dryden Rubber Division, Sheller Mfg. Co.

Golf winners were: low gross, (tied) members, Lou Lukity, Dryden Rubber, and Milt Leonard, Columbian Carbon Co.; third low gross, members, Don Zimmerman, United States Rubber Co., and Francis Frost, Frost Co.; low gross, guests, R. Cox; second low gross, R. Rand.

Blind bogey winners were Jack Riley; A Ginsfredi; and Norm Hansen, Chicago Rawhide. Peoria handicap (members) winners were W. Wood; Frank Harder, Williams-Bowman Rubber Co.; and Don Bernardi, W. H. Salisbury Co. Peoria handicap (guests) winners were B. Hardt and H. Ludecke.

High gross honors went to Al Cobb, Godfrey L. Cabot, Inc. Best putter on the club-house green was Don Eckhart; on the course was George Popp, Phillips Chemical Co.

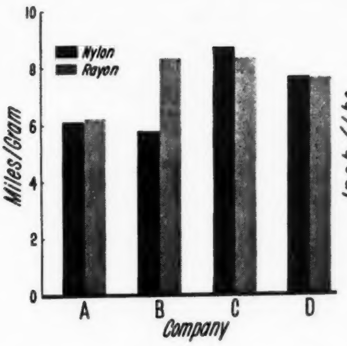


Fig. 1. Comparison of tread wear of nylon *versus* Tyrex rayon tires made by four different tire companies

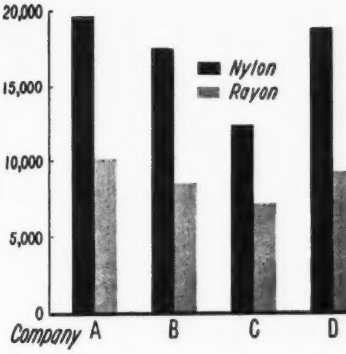


Fig. 2. Plunger test on tires of four different companies

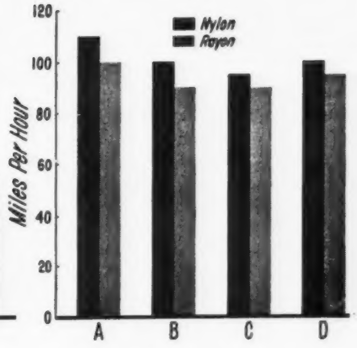


Fig. 3. High-speed laboratory wheel tests

Comparison Nylon *vs.* Tyrex Tires[1]

By D. H. HECKERT

Textile fibers department, E. I. du Pont de Nemours & Co., Inc. Wilmington, Del.

TWENTY-FIVE years ago the Du Pont company began a major research effort directed at producing and achieving acceptance of man-made fibers as reinforcement for rubber products, including both tires and belting. Rayon soon gained acceptance, but later nylon was offered and used by the tire companies to do a job for the military that could not be done by either rayon or cotton.

Continuing research has led to improved performance and improved economics in both nylon and rayon yarns for tire cord.

I should like to review for you now the present performance level of commercial tires made with these fibers.

Those of you not closely associated with the tire industry are probably very much confused and perhaps amused at claims and counter-claims in present-day advertising of the two textile fibers now being used in tires. Rayon tire yarn producers are making the same claims for Tyrex rayon cord ties as made for nylon cord tires by the nylon producers. In both cases performance data and laboratory data are being presented to support the statements. Actually the explanation for this fact is quite simple. The cord processing, tire building, and tire curing technology used to produce the tires to be tested is the deciding factor as to which tire cord has the best overall performance. Of course, the way tires are tested and how the data are interpreted also are factors.

We have just completed the testing of commercial first-line nylon cord and first-line Tyrex rayon cord tires. An equal number of nylon cord and rayon cord ties were purchased from local stores who certified that the rayon cord tires contained Tyrex. Fleet testing was done by a commercial fleet in Texas, and the laboratory data to be shown were developed in our laboratory using trade-accepted tests.

Tread Wear

Looking first at treadwear data (Figure 1) we see that nylon cord tires produced by companies A, C, and D gave about the same rate of wear as the Tyrex rayon cord tires made by these companies. Nylon cord tires produced by company B did not do so well as Tyrex rayon cord tires made by company B. Obviously, nylon cord tires with good tread wear are being produced commercially and are available at local tire outlets.

Plunger Test

A good measure of the strength of a tire carcass is found in a plunger test. These tests (Figure 2) measure the force required to drive a plunger through the tread of a fully inflated tire. The plunker used is 1¼ inches in diameter. The plunger value is an indication of the tire's toughness and resistance to impact damage. It is apparent that the nylon cord tires hold a 2:1 advantage over rayon cord tires.

Laboratory Wheel Tests

Looking next at laboratory high-speed data (Figure 3), we see that in each case the nylon cord tires ran five to 10 miles per hour faster than

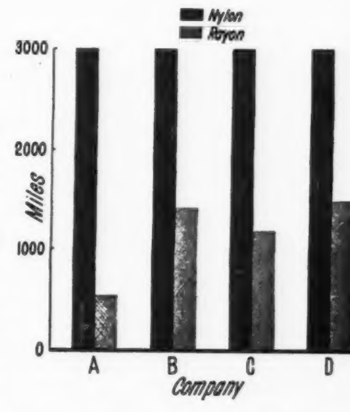


Fig. 4. High-speed laboratory endurance tests

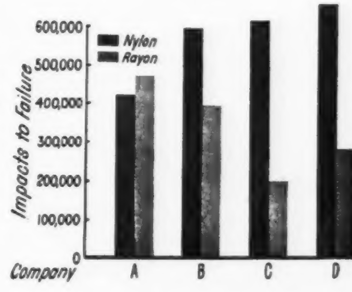


Fig. 5. Crown impact endurance tests, new tires

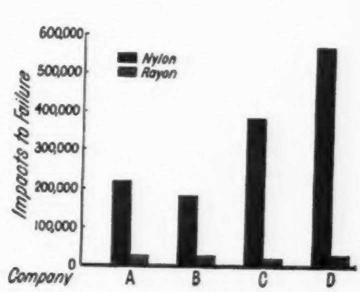


Fig. 6. Crown impact endurance tests, after 15,000 miles' fleet testing

[1] Remarks made at Rubber & Plastics Division, ASME, meeting, St. Louis, Mo., June 15, 1959, and reported briefly in RUBBER WORLD, July, 1959, p. 587. (This complete text was not available in time for the July report and is presented to prevent any possible misinterpretation. EDITOR.)

the rayon cord tires produced by a given manufacturer. These data were developed on a test wheel using standard step-speed tests.

Figure 4 shows the high-speed endurance performance of nylon cord and Tyrex rayon cord tires. The nylon cord tires all ran 3,000 miles on the wheel at 75 miles per hour with an overload of 20%. All of the Tyrex rayon cord tires failed at less than 1,500 miles.

Crown Impact Tests

In the laboratory the bruise resistance of new Tyrex rayon cord and nylon cord tires is found to be good (Figure 5). The Tyrex rayon cord tires failed in the range of 200,000 to 500,000 impacts owing to blowouts; while the new nylon cord tires failed because of loss of tread at between 400,000 and 650,000 impacts with no loss of air.

The impact resistance of the same tires after 15,000 miles of fleet testing is another story (Figure 6). Failure in each case was due to a blowout, and the Tyrex rayon cord tires all failed at less than 31,000 impacts; whereas the nylon cord tires failed in the range of 175,000 to 550,000 impacts. Thus we see a 17:1 advantage for the nylon cord tires over the Tyrex rayon cord tires after 15,000 miles of service. These data show that the bruise resistance of a rayon cord tire falls off rapidly as the protective tread rubber wears away and explain the increased frequency of bruise breaks as rayon cord tires build up mileage.

Summary

The performance of these tires is far better than that observed on commercial tires produced back in 1954 and 1955. Undoubtedly, the tire companies will continue to improve the performance of their tires as new yarns and new technology are developed.

The tire companies have taken advantage of the improved yarns as they have been offered to improve tire performance and or reduce the tire cost. Today a better tire can be bought at a lower cost than at any time in the past.

MIL Specifications Are Up Dated by Navy

The following new or revised military specifications have been announced by the Department of Navy, Bureau of Ships, Washington, D. C.:

Military Specification MIL-M-910 (SHIPS); Mats, Floor, Standing, Synthetic Rubber, Shipboard Use. This is an extensive revision of the specification covering shipboard mats to relieve personnel of fatigue due to vibration and long periods of standing watches. These mats consist of a cellular base with a bonded, solid plastic elastomer cover having a ribbed or other suitable finish.

Military Specification MIL-19379A (SHIPS); Mounts, Resilient, Mare Island Types 11M25 and 10M150. This is a revised specification to describe the 10M50-type mount. This mount has a load range from 25 to 50 pounds in the natural frequency range of 9 to 15 cycles per second.

Military Specification MIL-G-20080B; Gloves, Cloth, Coated. This is an extensive revision of the specification for coated Canton flannel gloves used for hand protection in rough work. Two types, knitted cuff and gauntlet, and two grades, vulcanized neoprene and vinyl plastic coatings, are described.

Military Specification MIL-H-21394 (SHIPS); Hose Assemblies, Synthetic Rubber, Aviation Fuel, Discharge, Non-Collapsible. This new specification covers four-inch i. d., 50-foot length, lightweight, suction and discharge hose for handling petroleum aviation fuels and suitable for reel stowage.

Military Specification MIL-G-21569 (SHIPS); Gaskets, Cylinder Liner O-Ring, Synthetic Rubber. This new specification covers synthetic rubber, O-ring gaskets for sealing diesel-engine cylinder liners. Two types, for oil resistance and high-temperature use, are described.

Military Specification MIL-G-21610 (SHIPS); Gaskets, Heat Exchanger, Various Cross-Section Ring, Synthetic Rubber. This is a new specification for synthetic rubber gaskets used in shipboard equipment for heating or cooling various petroleum oils. Two types, nitrile and silicone elastomers, are covered.

Military Specification MIL-M21649 (SHIPS); Mount, Resilient, Type 5M10,000. This new specification describes a mount with a capacity of 5,000 to 10,000 pounds and a natural frequency of 5 ± 1 cycles per second. A complete assembly consists of three components: a compression mount, a shear mount, and a snubber.

Military Specification MIL-G-22004 (SHIPS); Gasket, High-Temperature Lighting Fixture. This is a new specification describing special shaped, synthetic rubber gaskets for long-term, high-temperature sealing of shipboard lighting fixtures.

Military Specification MIL-G-22050 (SHIPS); Gasket and Packing Material, Synthetic Rubber, Non-Flammable, Hy*draulic Fluid Resistant.* This is a new specification covering gaskets, packings, and seals for various shipboard equipment using aryl phosphate ester fluids.

Specifications MIL-G-21569, MIL-G-21610, MIL-M-21649, MIL-G-22004, and MIL-G-22050 contain a qualification clause. Accordingly, awards will be made only for such materials or items as have been tested and approved for inclusion in the applicable qualified products list. Thus manufacturers are urged to have the materials or items which they propose to offer to the Federal Government tested for qualification so that they may be eligible for awards of materials or items covered by these specifications.

Ninth Canadian High Polymer Forum

The ninth Canadian High Polymer Forum will be held October 26, 27, and 28 at the Guild Inn, Toronto, Ont., Canada. The committee requests that those interested please note that these dates are different from those contained in the first announcements of the Forum. Chairman of the Forum is M. H. Jones, Ontario Research Foundation, Toronto; program chairman is L. A. McLeod, Polymer Corp., Ltd., Sarnia, Ont.; and secretary-treasurer is K. E. Russell, Queen's University, Kingston, Ont.

This Forum, sponsored by the National Research Council of Canada in cooperation with the Chemical Institute of Canada, is devoted to all aspects of polymer science.

Persons planning to attend are requested to make reservations directly with the Guild Inn by writing the Convention Manager, The Guild Inn, Scarborough Village P.O., Ontario, Canada. The daily cost per person is $12.50 including three meals and accommodations in twin-bedded rooms.

The Forum will consist of six sessions: one each morning and one each afternoon of the three days the Forum will be held. These sessions will consist of 23 papers on many different phases of high polymer chemistry.

In addition, there will be a banquet on the evening of October 27, with C. H. Bamford, director of research, Courtaulds, Inc., Maidenhead, England, as principal speaker. Dr. Bamford will speak on some of his current work which includes studies into phenomena associated with heterogeneous vinyl polymerization, including trapped radicals; the interaction between polymer radicals and salts in non-aqueous solution; the reactivities of free radicals; the preparation of block and graft copolymers; and the synthesis of polypeptides by polymerization of N-carboxy-α-amino acid anhydrides.

WASHINGTON REPORT

By JOHN F. KING

RMA and URWA Square off In Washington Labor Bill Fight

The stormiest session of this Congress, or any other in recent memory, found the rubber industry's management and labor ranged against one another in the hot and heavy lobbying that preceded the House vote on August 13 approving the Landrum-Griffin labor reform bill.

Management won the day—thanks to the revelations of union racketeering by the McClellan Committee in the Senate, the revival of the old Southern Democrat-Conservative Republican alliance in the House, and a television appearance by President Eisenhower on August 6 in support of the Landrum-Griffin bill.

Labor still has a chance to even the score in the Senate-House conference set for late August to iron out a compromise reform bill. To the casual observer, however, the most labor can hope to salvage from its beating in the House is no bill at all. Such action is considered possible, but not probable.

In the thick of the lobbying was The Rubber Manufacturers Association, Inc., promoting the Landrum-Griffin bill and the United Rubber, Cork, Linoleum & Plastic Workers of America (AFL-CIO) urging enactment of the bill sponsored by Rep. John Shelley (Dem., Calif.), and if not that, then the House Labor Committee's carbon copy of the bill sponsored by Sen. John F. Kennedy (Dem., Mass.).

RMA Activities

The recently organized Public Affairs Committee of the RMA got in the first licks. On July 29 it notified its rubber company membership that the House Labor Committee bill, which so closely followed Kennedy's bill, failed to deal with any of the problems involving labor's abuse of its power. Quoting the U. S. Chamber of Commerce, the RMA's Public Affairs Committee said that if the Senate's proposals to curb labor were approved, "Corrupt officials of labor unions will be the winners because the legislation will not hinder them and they will be entrenched for years to come."

The RMA Committee continued: "Political realities make it impossible to pass a labor bill including all of the corrective provisions advocated by business . . . to strike a balance in union-management relations."

But noting the Southern Democrat-Conservative Republican move to substitute the Landrum-Griffin bill for the House Labor Committee bill, the RMA group advised its management membership to get in touch immediately with their Congressmen to urge passage of the Landrum-Griffin bill. The stronger bill will win, the RMA group advised, "provided you and like-minded business men urge your Representatives to support this bill."

URCLPWA Moves

On August 5, one day before President Eisenhower took to the airways to support management's point of view on the matter, the leadership of the URCLPWA made its moves.

URCLPWA President L. S. Buckmaster told all locals representing the unions 175,000 members in this country to get after their Congressmen "not later than Tuesday, August 11," to urge passage of the Shelley bill.

This measure, Buckmaster said, is the "sound, practical, sensible method of dealing with the problem exposed by the McClellan Committee. . . . It will get at the crooks in the Labor movement. . . . (and) will not harm legitimate trade unions." The Shelley bill, Buckmaster concluded, "proves what we have long contended: that anti-racketeering legislation that is not anti-labor can be drafted," the implication being that the Landrum-Griffin bill would be "extremely harmful to all honest, decent trade unions."

Temporary Lull

The battle lulled temporarily in mid-August when the Senate faced the fact that it would have to sit down with the House and work out a compromise. Although the differences in the House and Senate bills seemed formidable, the House measure has 80 amendments the Senate has never seen, majority leader Sen. Lyndon B. Johnson (Dem., Tex.) and Senator Kennedy promised to go at the conference sessions in good faith searching for compromise. Johnson promised to keep the Senate in session until January to get a bill, if need be.

Wage Talks Begin

On a less spectacular, yet equally important aspect of management-labor relations in the rubber industry, meanwhile, negotiations between the Big Five companies and URCLPWA on the union's demand for a general wage increase began on August 18. Between that date, when the union's talks with Goodyear Tire & Rubber Co. start, and September 1, negotiations also will get under way with U. S. Rubber, B. F. Goodrich, Firestone Tire & Rubber, and General Tire & Rubber companies. The companies will have 60 days from the date of the first union notice of wage contract "reopening" to conclude new contracts. These 60-day periods expire between September 1, Goodyear's deadline, and September 17, General's.

In other developments, URCLPWA negotiated new fringe benefit contracts, not covering wage increases with Lee Rubber & Tire Corp., and Armstrong Rubber Co. The union in August served notice also on the Richardson Co. to reopen contracts for wage increase negotiations covering Richardson's 1,500 employes in its several plants.

No More Stockpile Rotation in 1960

The rubber stockpile rotation program has been scrapped for the balance of fiscal 1960 and perhaps for all time.

Beginning some time early next year, the General Services Administration is expected to start selling off an estimated 40,000 tons of stocked rubber. This is the amount GSA originally planned to rotate in the current fiscal year, but Congress intervened, and, rather than replace the rotated rubber with new material, GSA must now simply get rid of the deteriorating 40,000 tons.

Legislative Recap

Rubber rotation is ending primarily because Congress wanted it ended. The decision, however, was helped along by Administration officials who for some years have worried that the bulking $8-billion hoard of strategic materials would remain on the government's hands forever unless liquidation were begun. Ending the rubber rotation program and selling off the 40,000 tons originally earmarked for rotation is a modest, but welcome start toward a stockpile scaledown in the view of stockpile managers.

The end came when the Senate and House Appropriations committees shaved GSA's request for fiscal 1960 rotation funds to $17 million. This money will be used to finance the rotation of perishable items other than rubber in the stockpile, such as strategic fibers and industrial oils, but GSA is prohibited from using any of the money for rubber rotation.

The Senate-House bill, which the Senate still had to approve in mid-August (although this was just a formality), was a compromise of widely divergent versions of the GSA money bill that came out of the two chambers. Earlier in the session the House chopped all appropriations for purchase of new stockpile materials for GSA's budget request for $107 million and allowed the agency only $33 million for maintenance of the whole $8-billion stockpile in the year that began July 1.

The head of GSA, Franklin Floete, appealed to the Senate to restore some of the rotation funds killed by the House. He argued that the 1946 National Stockpile Act forbade the disposal of inventory items unless they are replaced, which is to say rotated. The Senate, always more reasonable where appropriations are concerned, voted to give GSA $50 million with which to acquire new materials in the current fiscal year. About $27 million of this total was earmarked by the Senate for the rotation program.

In the legislative conference to iron out differences between the Senate and House versions, the compromise on rotation funds was the $17-million figure insisted upon by the House and accepted by the Senate. With the Administration's approval, the conferees specified that the trimmed down rotation fund be limited to perishables other than rubber.

The House passed the compromise bill early in August, but the Senate had not acted because of a disagreement over civil defense funds included in the same appropriation. It was a foregone conclusion that the conference bill would go through the upper chamber before adjournment.

OCDM Sell-Off Plan

Even before the measure becomes law, the Office of Civil & Defense Mobilization, which has policy responsibility over the stockpile, was hard at work on a plan for the sell-off of the 40,000 tons of rubber decreed in the appropriation act. OCDM regards the appropriation act as the necessary Congressional approval to sell stocked materials, but it still plans to send its disposal plan to Capitol Hill and observe the traditional six months' waiting period before actually undertaking sales. Thus it will be late January or early February before rubber sales actually begin. Presumably the whole 40,000-ton lot will be sold off before June 30, the end of fiscal 1960.

House Committee Compromise On Increased Highway Taxes

The rubber industry and its business allies in the automotive, transport, oil and farming industries, lost an important battle in the House Ways and Means Committee over increased "user-taxes" to finance the federal highway program. But the war is not over. The Committee's August 13 vote to raise industrial user-taxes still must be upheld on the House floor and later approved by the Senate.

Committee Action Slow.

The Ways & Means Committee, which must originate tax legislation, has floundered around with the highway tax proposals since they were made last January by President Eisenhower. The Committee's membership was, on the whole, completely out of sympathy with the President's recommendations, but had to do something. The growing deficit in the Highway Trust Fund, coupled with the so-called Byrd amendment which required construction of the 41,000-mile interstate network to proceed on a "pay-as-we-go" basis, forced upon the Committee the unpleasant tax-increase recommendations.

The Committee resisted as long as it could. It even cooked up some fiscal substitutes to avoid voting for higher taxes on gasoline. But in the end it surrendered to the persistent Administration. Mr. Eisenhower did not get everything he wanted, but what was finally wrung from the Committee was pronounced satisfactory to the White House.

In his budget message the Chief Executive last January proposed a 1½¢-per-gallon increase in federal taxes on gasoline, diesel oil, and other highway fuels. The increase, which would have boosted the federal fuel levy to 4½¢, was requested to avert a $3.5-billion deficit in the road trust fund between fiscal years 1960 and 1962.

RMA Proposals

Speaking for the rubber industry earlier this year, Ross R. Ormsby, president of the Rubber Manufacturers Association, protested the gas-tax proposals and urged Congress to make up the trust fund deficits with appropriations from the Treasury's general fund.[1]

In late July, when the Ways & Means Committee was wrestling with the financing issue, Ormsby recommended that Congress either suspend the Byrd amendment, which requires cash on the counter before road construction can proceed, or issue short-term revenue bonds with Highway Trust Fund receipts as collateral.

In any case, he told the Committee, only "interim" action should be taken in meeting the financing crisis at the present time. Longer-term plans should be based on the studies now being made on the most equitable means of spreading the cost of the mammoth construction program among all beneficiaries, Ormsby said.

Byrnes Compromise

The Committee hemmed and hawed, made several abortive attempts to resolve the thorny issue of how to proceed, and then on July 29 approved a plan to issue $1 billion in revenue bonds to keep road construction on schedule through the balance of fiscal 1960. The action kicked up a storm of protest, however, because the bond-issue proposal was tied to a slowdown in roadbuilding in 1961 and following years. The slowdown would have stretched out the building program four years beyond the 1972 completion date.

Bowing to private and public pressure, the Committee reconsidered and on August 13 adopted a two-part compromise offered by Rep. John W. Byrnes (Rep., Wis.) for a 1¢ per-gallon gas-tax increase to go into effect September 1 this year and continue until June 30, 1961. The second part of the Byrnes compromise would earmark a portion of manufacturers' excise taxes on such items as autos, tires, tubes, and accessories for the Highway Trust Fund. The earmarking would commence June 30, 1961, and continue to June 30, 1964.

The 1¢ tax increase would generate $960 million over the 22 months it would be in effect, and the excise tax earmarking program about $2.5 billion over the four years' of its duration. Together, these two devices are deemed sufficient to keep the building program nearly on schedule.

[1] See RUBBER WORLD, Feb., 1959, p. 719.

Business Regulation Bills Fare Poorly This Session of Congress

The first session of the 86th Congress seems to have been something of a washout with respect to the preseason guesses of the experts that the heavily "liberal" Democratic majorities in both Houses would make it tough for business. A number of business-regulation bills, in which the rubber industry among others was interested, came close to passage. But few made it. Those which failed to make the grade will get another chance next year.

One Anti-Trust Bill Passed

Although the first session had not ended at RUBBER WORLD's deadline, the spotty performance record of the 86th Congress can now be outlined. Here is what it looks like:

In the anti-trust field, a number of major pieces of legislation were thoroughly aired in extended hearings on one or both sides of the Capitol. In most of them the rubber industry had a keen interest, but as matters turned out, only one was enacted into law. This one was strictly non-controversial until after it had passed, and the Federal Trade Commission set about applying it in practice.

The bill makes final and binding, immediately upon their issuance, all cease and desist orders put out by FTC or any other government regulatory agency. The idea of the legislation was to speed up the cumbersome, three-step procedure under which these orders had been previously enforceable.

What stirred the controversy after enactment was the FTC interpretation of the act to mean it can be applied retroactively to orders issued under section 11 of the Clayton Act. Clayton Act orders go back to 1914 and involve some 200 companies, some in the rubber industry.

Anti-Trust Bills Shelved

Anti-trust bills which were shelved at least until next session because of opposition, indifference, or both, include the following:

(1) S-11—that hardy perennial which Congressional "liberals" have sought to enact for the past five years. It would have limited the "good faith" defense in price discrimination cases, but it never got out of committee in either the House or Senate.

(2) Premerger Notification—this fared even worse, not even getting to hearings on the House side and never seeing the light of day from its Senate committee pigeonhole. The bill would require merging companies to give the government 60 days' advance notice of their combination plans.

(3) Civil Investigative Demand—this measure would have given the Justice Department the right to subpoena all relevant documents in civil anti-trust suits and was strongly opposed by the rubber industry. The measure died in the House Judiciary Committee in the face of conservative opposition after having passed the Senate.

FTC Influence

Certain other legislation in the business regulation field followed closely by rubber industry representatives met hard going. Much of the credit for slowing them down belongs to the new FTC chairman, Earl Kintner, who since taking over the regulatory agency earlier this spring has launched a personal campaign against special interest legislation in the business field. Along with William C. Kern, Democratic FTC member, the new FTC boss has flayed legislative proposals which attempt to take "loss" out of the profit-and-loss competitive system.

For example, Mr. Kintner has resisted the so-called Mandatory Functional Discount bill—which would require manufacturers to sell their products to persons classified as "wholesalers" at lower prices than to persons classified as "retailers"—on grounds it would put FTC in the price-fixing business. House Judiciary Committee Chairman Emmanuel Celler conducted hearings on the bill, but indicated there will be no action on it this year.

Chairman Kintner feels basically the same way about the Bentley bill, which differs from the Functional Discount measure in that it (a) would prohibit a manufacturer from selling to his own retail outlets at a price consistently lower than prices charged an independent retailer and (b) would forbid him to sell directly to a consumer at prices consistently lower than those charged either by his own or an independent outlet. This measure also got nowhere, as did other "fair-trade" type bills.

Chairman Kintner's strong and effective opposition to legislative attempts to "protect" segments of business or to "enforce" competitive conditions within industries came through clearly in the early summer hearings by the Senate Small Business Subcommittee's hearings on pricing practices in the tire distribution industry. These hearings, run by Sen. Hubert H. Humphrey (Dem., Minn.), were designed to air the grievances of the independent tire dealers against the rubber retailing operations of manufacturing companies. No legislation has resulted.

Many of these business-regulating legislative proposals have been around a long time. There is no reason to expect they will not be in the hopper next session, or in later years, ready for enactment if conditions are right.

INDUSTRY NEWS

Soviet Bloc Trade and Competition

The forthcoming exchange of visits of President Eisenhower to Russia and Premier Nikita Krushchev to the United States should make a recent publication entitled "The Communist World As Customer and Competitor," by Business International, 200 Fourth Ave., New York 3, N. Y., of special interest to American businessmen. The 30-page booklet is a study of the potential market for Free World goods in the Soviet bloc and the threat to private enterprise from the Communist "trade offensive" and is designed to help executives decide whether to try for sales to the Communist market.

This authoritative report indicates the difficulties in trade with Communist states including the problem of trading agencies and their policies, inability of U. S. businessmen to travel through the Soviet Union with samples and sales material, the difficulties of patent licensing, and the lack of foreign exchange to pay for increased imports. Ways in which the United States Government could help increase trade are listed together with a special section on U. S. trade controls, which has recently undergone revision although the basic structure remains the same. How the four basic documents, the Export Control Act, Foreign Assets Control Regulations, Transaction Con-

trol Regulations, and the Mutual Defense Assistance Control (Battle) Act, of the U. S. system of economic defense and strategic trade controls operate is explained in some detail.

In another section an analysis of the Soviet economy includes production figures for major industries in the USSR for 1958 and the first quarter of 1959; there is also a discussion of Russia's present foreign trade with the Free World and satellite nations, and a report of selected goals contained in the Soviet's seven-year plan for 1959-65.

The study contains original research of Business International's editors and its correspondents around the world. It sells for $36; subscribers to BI International weekly report on international trade and investment receive a 50% discount.

New "Z" Calender In F-B Laboratory

Farrel-Birmingham Co., Inc., Ansonia, Conn., recently installed in its process laboratory a new 8- by 16-inch, four-roll, inclined "Z" calender, which is expected to provide more exact test results in a complete range of operations than has before been possible with any single laboratory calender.

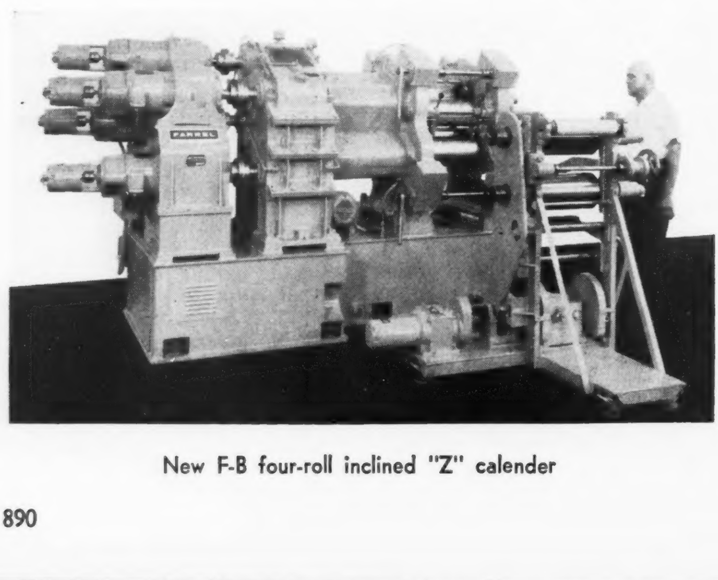
The calender features individual, adjustable-voltage, direct-current drive for each of its four rolls. This provides stepless variation in roll speeds in the wide range of six to 48 feet per minute; any required friction ratio is easily obtainable for any roll pair.

This drive flexibility, the advantage of the inclined "Z" roll arrangement, and an operating temperature range up to 500° F, all suit this machine for the following calendering operations under the requisite conditions for practically any experimental work: (1) unsupported film or sheeting, (2) unsupported double film or sheeting, (3) single coat on carrier, (4) double coat on carrier and (5) single frictioning.

Connected to the calender is a portable unit consisting of rolls for cooling or heating, idler rolls, let-offs and variable-speed, and motor-driven windup.

Another recent equipment addition to the laboratory, which has had popular use, is a Farrel-Inductomatic 3½-inch extruder, a special induction-heated extruder for plastics. The testing center also contains a sizable complement of production-capacity machines, including a 3D Banbury mixer, an 8½-inch extruder-pelletizer, a modern 22- by 60-inch two-roll mill, and a 21-inch and 24- by 36-inch two-roll tilted refiner.

Within a booking schedule which allows for confidential experimentation, the use of all facilities of the laboratory is available without charge or obligation, up to two full days within one year, to rubber and plastics manufacturers who wish to conduct tests with new materials or evaluate new processing techniques. Arrangements can also be made with the company for more extended periods of use on a fee basis.

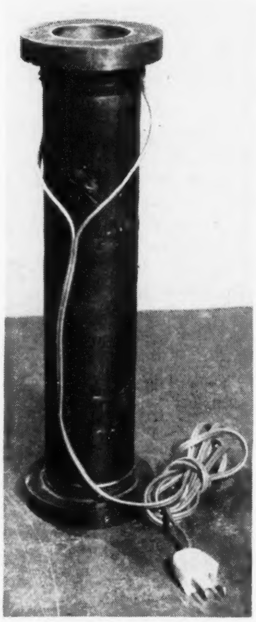


New F-B four-roll inclined "Z" calender

Electrically Heated Hard NBR Pipe

Luzerne Rubber Co., Trenton, N. J., has announced the development of an electrically heated rubber pipe. The hard NBR (nitrile rubber) pipe is heated by an unique non-circuitous silicone rubber tape developed by Sunelec, Inc., Trenton.

The pipe, which is lightweight and durable and will withstand temperatures up to 248° F., will be ideal for handling crude oil, acids, molasses, and any other material requiring a constant elevated temperature for flow.



A test sample section of Luzerne Rubber Co.'s NBR pipe with Sunelec Co. heating tape embedded. Pipe is designed to provide constant elevated temperature for flow of viscous materials

Liners of silicone rubber, Teflon, PVC, metals, or glass can be furnished on the inside of the pipe, and polyurethane or other insulating materials can be coated on the outside.

The cost of the electricity to heat the pipe will be low since only small wattage is required to achieve a temperature of 100° F., according to Richard D. Wingate, Sunelec president, who developed the tape.

The pipe will be manufactured in various lengths with diameters ranging from two to six inches and can be joined by use of couplings suitable to specific requirements. The pipe is quite light in weight. A 10-foot section of two-inch pipe weighs approximately 7½ pounds.

In addition to the industrial uses listed above, it is expected that the pipe will find many consumer applications such as domestic waste traps to liquefy accumulated fatty wastes, water and waste lines subject to freezing conditions, or any place where corrosive materials are handled and require heat.

The new pipe will eliminate the need of steam jacketing, outside steam tracers, or other heating methods and will handle corrosives that would eat through most metals. Besides, owing to ease of handling and installation this NBR pipe will be less expensive than many other types of piping.

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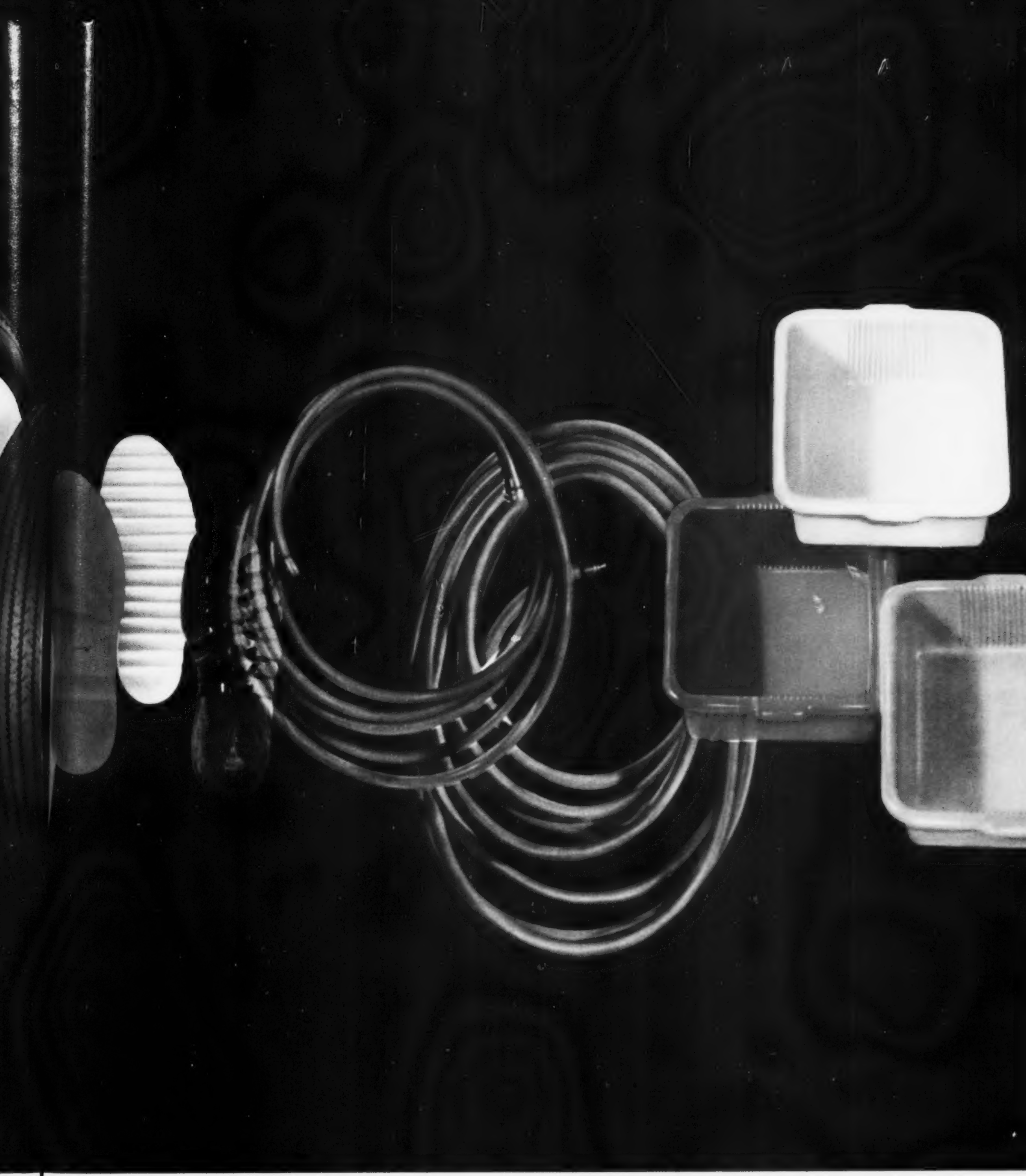

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Reclaimator Plant To Go up in Vicksburg

U. S. Rubber Reclaiming Co., Inc., Buffalo, N. Y, has acquired 34 acres in Vicksburg, Miss., for a plant to serve the middle south and southwest rubber market. Construction of a plant costing $1 million will start immediately, according to the company. The plant, which will produce Reclaimator rubber for automobile tires, highway joint seals, and road paving, will have an initial capacity of 70,000 pounds per day.

The company announced that a steady rise in the use of rubber products and an increase in the demand for reclaimed rubber dictated the expansion. Reclaimed rubber consumption for the first half of 1959 was 145,400 long tons, compared with 118,900 long tons for the same period in 1958. In terms of total consumption, the reclaiming industry produces 19% of all the rubber used in the United States.

Goodyear Forms Two New Sales Departments

Two new sales departments have been established within the chemical division of The Goodyear Tire & Rubber Co., Akron, O. The new departments, polyester products, and adhesives, join with the rubber and rubber chemicals, coatings, and plastics departments to bring the division's total sales units to five.

The new departments, according to C. O. McNeer, general sales manager of the division, were established to coordinate more fully sales efforts and services which the division renders to the relatively new and important polyester and adhesives fields.

Appointed manager of the polyester products department was L. P. Thies, former head of the division's Detroit office. In his new post he will be responsible for sales and technical sales service of Goodyear's polyester resin, Vitel, to the fiber and the textile industries.

W. E. Kelly, former manager of the division's St. Louis office, was named to head up the new adhesives department and will work with R. S. Sanders, manager of Pliobond sales, to coordinate the sales activities of the division's entire line of adhesive materials.

Thies joined Goodyear in 1956 with extensive experience in the fields of vinyl plastisols and industrial finishes. He was first assigned to the division's Cleveland office and was made district manager at Detroit in 1958.

Kelly has been with Goodyear since 1949 and had previous experience in textile and adhesive sales. He was assigned to the division's New York office and in 1954 was transferred to the St. Louis office as district manager.

L. P. Thies

W. E. Kelly

Dacron/Terylene Cords Checked by Firestone

Research undertaken by The Firestone Tire & Rubber Co., Akron, O., indicates that polyester fibers such as Dacron[1] and Terylene[1] soon could be used in tire construction, according to Raymond C. Firestone, president. The company's research findings were a result of a program centered on a wide range of fibers during which more than a million test miles had been logged on tires which were built with new synthetic fibers.

The findings, stated Firestone, proved conclusively that Dacron and Terylene as tire cords, are equal or superior to any fabrics now used in premium tires. These cords compare favorably in strength with any cord in use today, it is said. Tires built with these cords were claimed to give increased mileage and an improved ride due to the elimination of flat spotting.

The new fibers were checked for adhesion, strength, and flex fatigue resistance. In field tests no tire has failed from either adhesion or flexing.

The next step in Firestone's development program will be to equip fleets in various parts of the nation with Dacron and Terylene tires, and these results will then be compared with earlier findings for further evaluation of the new cord material.

Outdoor tests were conducted on Firestone's 7.7-mile proving ground at Fort Stockton, Tex. Tests also were carried out using fleets in Akron, O., and Baltimore, Md. The results of these proved the potential of polyester fibers for tire cord applications.

[1] See RUBBER WORLD, July, 1959, p. 587.

Dow Corning Will Aid Medical Research

Dow Corning Corp., Midland, Mich., has announced the founding of the Dow Corning Center for Aid to Medical Research. D-C president, Dr. W. R. Collings, stated: "During the past several years a number of remarkable advances have been made in medicine and surgery by using our silicones in a variety of forms from fluids to rubber. The interest among physicians and surgeons has grown so great that we have had to assign two of our best scientists to act in a liaison capacity between physicians and surgeons and our research laboratories."

The purpose of the new center will be to aid medical research by supplying technical assistance, by acting as a clearing-house for information about the use of silicones in medicine and surgery, and by cooperating in research in organosilicon chemistry in relation to the human body.

Offices of the new center will be at Midland. The director will be Dr. Rob Roy McGregor, and the executive secretary, Silas A. Braley. Dr. McGregor is one of the first inventors of commercial uses of silicones. Formerly a Fellow of the Mellon Institute, Pittsburgh, he has been a member of the research team of Dow Corning since its founding in 1943. Assistant director of research, he has in recent years given his time to relations with the U. S. Food & Drug Administration and with the medical profession. Braley, once an associate of McGregor's at Mellon, has been at Dow Corning since 1951, most recently as a supervisor in the product engineering Silastic laboratory.

John M. Hussey

Goodyear Fetes Hussey

Twenty-five years of continuous service with The Goodyear Tire & Rubber Co. were celebrated recently by John M. Hussey, district manager for the Goodyear chemical division at Boston, Mass.

During a dinner-party attended by friends and business associates in Boston, Hussey received a 25-year pin from H. R. Thies, division general manager. A number of other gifts appropriate to the occasion also were presented to Mr. and Mrs. Hussey.

Hussey started with Goodyear's service department in 1934 and did sales work in Buffalo and Indianapolis. He returned to Akron in 1942, when he was assigned to Goodyear Aircraft Corp.

In 1945 he was made technical salesman for Goodyear's plastics and coatings department. In 1946 he became special representative in New York, and later Boston, selling chemicals. Mr. Hussey was appointed district manager at Boston when the chemical division was officially organized in 1948.

In 1953 he was awarded the Litchfield Medal as the top Goodyear domestic salesman.

He is a member of American Chemical Society, the Boston, Connecticut, and Rhode Island Rubber groups, TAPPI, and many other professional and business organizations. At present, he is a director of the Boston Rubber Group and of New England Paint, Varnish & Lacquer Association.

Servus Rubber Expands

Servus Rubber Co., Rock Island, Ill., has purchased a section of the former Birtman Electric Co. plant, of the same city. The acquisition will add 85,000 square feet of manufacturing space to be used for the production of rubber-sole footwear and the handling of raw materials and finished goods, reported C. E. Little, Servus president.

Certain manufacturing operations now in the company's main plant will be moved to the new factory. An additional 100 to 150 people will be employed by the firm, bringing to 1,400 the number of Servus employes in this area. Moving of machinery and equipment into the new plant began about September 1.

The company's increased sales throughout the United States made it imperative that Servus grows with the national economy, stated L. M. Rishell, vice president in charge of sales. The new facilities will enable Servus to give its customers continued good service.

Belgium Steel Cord

Bekaert Steel Wire Corp., 655 Madison Ave., New York, N. Y., has special types of steel cord available for use by rubber manufacturers in truck tires, belts, hose, or any other product requiring steel wire reinforcement. This office is the American subsidiary of Bekaert Steel Cord, S.A., Zwevegem, Belgium, which claims to be the second largest producer of wire in the world, conceding that the American Steel & Wire Division of U. S. Steel is the world's largest producer.

In a descriptive booklet on the uses of steel cord in rubber products the company lists some of the advantages of using its special cords as well as giving specifications on the Swedish steel used. Used in truck tires the steel cord is said to increase mileage up to two or three times, to permit more retreadings with greater safety, to permit higher load capacity of vehicle, and to allow the tire to run a great deal cooler than those made with textile cords. The cords are finished to provide superior adhesion to rubber and be stronger, tougher, and more heat resistant than any other on the market. Many of these same advantages are also claimed for the use of the cords in conveyor, timing, and V-belts as well as reinforced hose.

While inventory build-up in anticipation of the impending strike in the U. S. steel plants probably caused steel imports to exceed exports in the first half of 1959 for the first time in history, there seems to be little doubt that imported steel products will play a very important part in the future steel picture in the United States.

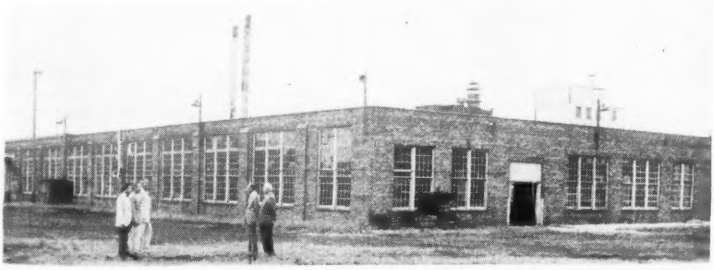
Moreland Expands Plant

The Moreland Corp., largest exclusive manufacturer of printing and industrial rollers in the United States, has enlarged its Willow Grove, Pa., plant by nearly 30%. While the addition is devoted exclusively to the production of large (up to 30 feet long by 6 feet diameter) rollers, the new section permitted the facilities for smaller rollers to be expanded into the area formerly devoted to large rollers.

The addition, planned and constructed by Wm. F. Lotz, Inc., Philadelphia, Pa., utilizes the newest, most efficient materials-handling techniques. Large indoor loading bays enable the largest over-the-road trailers to be backed inside the plant and unloaded by a 10-ton traveling crane. Other features include mechanical dock-boards and trolleys on which the large rollers can ride into the new 30-foot vulcanizer to eliminate handling. This new vulcanizer is heated by a new 200 hp. boiler system which also heats the building and other vulcanizers.

The expansion made possible a new highly efficient materials-handling system with separate dock facilities for receiving and shipping. Incoming materials arrive adjacent to the warehousing area and the beginning of the production line. Shipping is handled at the opposite end of the building. Likewise, the extremely large rollers are shipped from another dock in the new wing. As part of the expansion, the offices have been renovated, and a new, separate production control office installed.

Moreland makes rollers for applications in such fields as graphic arts, paper, textiles, rubber, plastics, and many other areas.



Servus officials inspect new acquisition

New York Times
Simon Collier

Collier Retires From Johns-Manville

Simon Collier, a national authority in the field of industrial quality control and active for many years in the rubber industry as chairman of Committee D-11 on Rubber and Rubber-like Materials of the American Society for Testing Materials, retired on June 30 after 36 years with the Johns-Manville Corp., where he had been director of quality control since 1946. Mr. Collier was also chairman of the ASTM Committee E-11 on Quality Control and was a director of ASTM from 1948 to 1951.

Mr. Collier received his B.S. in chemistry from Worcester Polytechnic Institute in 1916 and worked first for the Boston Belting Co. He was a chemist at the National Bureau of Standards 1917-18 and again 1919-1923, working in the rubber field and while at the Bureau was responsible for the publication, "Methods of Analysis of Rubber Goods."

He joined Johns-Manville at Waukegan, Ill., in 1923 as chief chemist. In 1936 he became manager of inspection and control with headquarters in New York, N. Y., and in 1946 was appointed director of quality control with responsibility for production standards for more than 500 different lines of products.

Mr. Collier is a founding member of the American Society for Quality Control and has served as executive secretary, vice president, and president of that organization. In addition, he is a member of the American Chemical Society and its Rubber Division, of which he is a former member of the board of directors, and is a member and past chairman of the New York Rubber Group. He includes the American Institute of Chemists and the Chemists Club of New York among his other affiliations.

A pioneer in applying the statistical approach to quality control, he has scheduled a series of lectures before technical societies, industry, and universities. He is remaining as chairman of ASTM Committee D-11 until February, 1960, after which he will serve the committee in whatever capacity required. Mr. Collier expects to remain as active as possible in his retirement.

Goodyear Plans Tire Plant in West Canada

The Goodyear Tire & Rubber Co. of Canada, Ltd., New Toronto, Ont., Canada, plans to start construction immediately on a $4.5 million tire plant in Medicine Hat, Alta. The one-story building, which will contain 84,000 square feet of floor space and will be built so that it can be readily expanded, will produce passenger-car, truck, and farm tires for the western Canada market as well as tread compounds for the expanding retread business.

Goodyear (Canada) president, L. E. Spencer, announced that production would begin by September, 1960, with an initial employment of some 135 persons. The work force is expected to be increased soon thereafter. The initial annual payroll will exceed $1 million, he stated.

The plant will be located on a 75-acre site north of the Saskatchewan River, adjacent to the main C. P. R. line and near the Trans-Canada Highway. The company has also purchased mineral rights to a natural gas well adjacent to the plant property, which will supply the plant with fuel. The plant will use 8.3 million cubic feet of gas monthly, plus approximately one million kilowatt hours of electricity and 43 million gallons of raw water.

The Medicine Hat plant will be Goodyear's first manufacturing facility in western Canada and its fifth Canadian plant. Contract for the plant's design has been awarded to Foundation of Canada Engineering Corp. Construction will be by Foundation Co. of Canada, Ltd.

NEWS BRIEFS

THE FIRESTONE TIRE & RUBBER CO., Akron, O., has introduced its Tempa Spare, a miniature pneumatic replacement for the spare tire that takes up half the storage space required by a full-size spare, yet is more than adequate in a highway emergency. The rugged temporary replacement operates efficiently on any wheel position, with practically no decrease in car stability, comfort, and handling. Its section width for replacement of a 7:50-14 conventional tire is five inches as compared to 7½ inches. The combination Tempa Spare wheel and tire has a 22-inch overall diameter, compared to 27, and weighs 20 pounds, as compared to 39 pounds for the conventional unit. The lighter, smaller Tempa Spare is easier to change on the road.

ALL CHEMICALS CO., New York, N. Y., supplier of chemicals for rubber and plastics, recently purchased the plant and warehouse at 110 Pennington St., Newark 5, N. J., and will occupy the premises at once. The new phone numbers are Market 3 8806-07-08.

B. F. GOODRICH INDUSTRIAL PRODUCTS CO., Akron, O., has announced a new abrasion-resistant, adhesive rubber sheeting for do-it-yourself covering of chutes and launders or patching of conveyor belt surfaces. Known as Armorline, the material can be applied to metal, concrete, wood, and other materials. A thin gage of tacky rubber is bonded to the undersurface side of the material, protected by Holland cloth which is removed before use. Neither expensive tools nor special skill is required for covering or patching equipment in the field, the company reports.

CORDUROY RUBBER CO., Grand Rapids, Mich., will show a special film on tire manufacturing at the National Tire Dealers & Retreaders Association Convention, which will be held at the Shoreham Hotel, Washington, D. C., September 12-17. The film, of interest to all people in the tire industry, will show in detail every step in the manufacture of a modern tire.

News Briefs

THE TIMKEN ROLLER BEARING CO., Canton, O., has solved the problem of keeping water out, and lubrication in the wheels of boat trailers through a combination of a "Duo-face" seal and an O-ring seal fitted into the bearing cone bore. Made of synthetic rubber-like material, the "Duo-face" seal is pressed on the inner race, or cone, of the bearing. One lip operates against the smoothly ground face of the cup, providing face-type sealing. The other lip of the seal operates in the inside diameter of the wheel hub, providing an outer diameter seal. A synthetic rubber O-ring which has been inserted into a small groove in the inside diameter of the inner race prevents water from seeping in between the axle and the inside diameter of the bearing cone.

RESIN RESEARCH LABORATORIES, INC., Newark, N. J., has established a new technical service department with a fully-equipped laboratory and complete staff for handling application problems in the local area. Manufacturers of resin and polymer materials are invited to take advantage of the new facilities. The staff is said to be technically competent and experienced in industrial sales development and sales motivation.

NEW YORK RUBBER CORP., New York, N. Y., is now delivering new models of "Brace-Fast" inflatable dunnage bags which incorporate design improvements. The dunnage bag is now a one-piece, bladderless product, built like a tubeless tire, and made of 13-ounce ballistic nylon with reinforced seams. This is coated with 0.024-inch neoprene outside and 0.036-inch neoprene inside. Overall weight is reduced, and a gain of 30% in strength is observed under pressure in the free state. The bags are used in the pneumatic bracing of both fragile merchandise and heavier items such as drums and containers.

THE GOODYEAR TIRE & RUBBER CO., Akron, O., has announced renewal and enlargement of its two-year-old aid to education program, providing in 1959, $161,000 in grants and scholarships to higher-education institutions in the United States. Administered by the non-profit Goodyear Foundation, direct grants in aid to schools and to foundations of independent colleges will total $116,000; the balance is for scholarships. In addition to the scholarship grants, each school participating in the scholarship program receives an unrestricted grant to help offset administrative and other costs not included in tuition. The Goodyear International Fellowship, which pays all expenses for one academic year to a student from a foreign country where Goodyear operates, has also been renewed.

CHIKSAN CO., Brea, Calif., has purchased the business and properties of Hamer Valves, Inc., Long Beach, Calif., according to L. S. Hamer, founder and president of Hamer Valves, and H. J. Hagn, president of Chiksan. Hamer Valves, established in 1928, produces quality plug valves, gate valves, and line blind valves for the petroleum and chemical process industries. Chiksan, a subsidiary of Food Machinery & Chemical Corp., is a leading manufacturer of swivel joints, tank car and tank truck loading equipment, and barge and tanker loading systems.

MINNESOTA MINING & MFG. CO.'S adhesives, coatings, and sealers division, St. Paul, Minn., has introduced a new high-performance curtain wall and building maintenance sealer, off-white in color, and especially designed to blend with light-colored masonry materials such as marble, limestone, and concrete. This liquid two-part polysulfide rubber-base product is designated "Weatherban" brand off-white curtain wall sealer. When mixed with a curing agent, it chemically cures in place to produce a solid rubber seal which possesses excellent flexibility, aging and non-flow qualities; high tensile strength; excellent adhesion to metal, glass, marble, limestone, concrete, porcelain, wood, and other common building materials; and excellent non-shrinking and non-cracking qualities, according to the manufacturer.

EVANS CHEMETICS, INC., New York, N. Y., has introduced a new organic sulfur, benzyl mercaptan (α-toluenethiol). The material undergoes typical mercaptan reactions and has been claimed as a polymerization activator with BF_3 catalyst. Data sheets and samples are available on request from the company.

A. E. STALEY MFG. CO., Decatur, Ill., recently acquired the U B S Chemical Corp., Cambridge, Mass., and at the same time assumed all obligations of U B S. In the transaction Staley delivered to U B S, 102,376 shares of common stock. These will be distributed to U B S stockholders on the basis of one share of Staley common for each 1¾ shares of U B S common stock. The Decatur corn and soybean processor is acquiring U B S to aid Staley's research and polymer chemical development and to diversify its product lines.

AUSTRALIAN PETROCHEMICALS, LTD., a new company formed by Monsanto Chemical Co., St. Louis, Mo., and Petroleum & Chemicals Corp., Ltd., Sydney, Australia, has begun construction of a multi-million dollar plant to produce styrene monomer at Silverwater, Australia. Manufacturing operations are scheduled to begin in 1961.

E. I. DU PONT DE NEMOURS & CO., INC., dyes and chemicals division, Wilmington, Del., has reduced prices of five of its fluoroalcohols to $10 per pound. Identified as C3, C5, C7, C9, and C11 fluoroalcohols, the compounds are recommended as intermediates in the manufacture of plastics, elastomers, lubricants, hydraulic fluids, instrument oils, dielectric materials, and corrosion-resistant coatings requiring high chemical stability and resistance to temperatures in the 250° C. range. Mixtures of the C3 and C5 fluoroalcohols also are available at $7.50 per pound for 1:1 mixtures and $8.50 per pound for those containing approximately one part of C3 to two parts, by weight, of C5 fluoroalcohol.

THE GARLOCK PACKING CO., Palmyra, N. Y., has developed a new series of mechanical seals for installation on sealed vessel agitator shafts. Known as Mechanipak seals, they are said to be completely self-contained in a single unit for simple, quick installation. The units are designed to prevent agitator shaft leakage at pressures up to 3,000 psi. and to withstand temperatures in excess of 700° F., even in corrosive environments. The seals are currently available in sizes to fit any shaft.

UNITED STATES RUBBER CO.'S Naugatuck Chemical Division, Naugatuck, Conn., has announced that 12 pounds of its Kralastic, a resin-rubber blend, are used in each new made-in-Italy Fiat 2100 car. The plastic material, marketed overseas by the rubber company's international division, is molded into windshield and window trim, steering wheel housing, and the entire dashboard.

LITHIUM CORP. OF AMERICA, INC., has started commercial production of *n*-butyllithium at its Minneapolis, Minn., plant with an initial output exceeding 1,000 pounds per month. The chemical is used as a catalyst in the manufacture of polyisoprene and polybutadiene synthetic rubbers. Manufacturing process is based on the reaction of lithium metal and butyl chloride, modified with significant technical improvements which will enable facilities to be expanded easily to meet increasing demand.

THE DOW CHEMICAL CO., Louisiana division, has completed facilities for the production of propylene oxide, propylene glycol, and dipropylene glycol at Plaquemine, La. These products are used as basic raw materials or chemical intermediates in the automotive, food, pharmaceutical, paper, cosmetics, soap, textile, plastics, rubber, and chemical process industries. Dow also produces these products at Midland, Mich., and Freeport, Tex.

News Briefs

UNITED STATES RUBBER CO., New York, N. Y., has licensed Ford Motor Co. to use a method for continuously laminating decorative and durable vinyl plastic sheet to metal. Ford becomes the first automotive company to be licensed to use the laminating technique, called the Marvibond process, developed in 1953 by Naugatuck Chemical. The auto firm is also the first licensee of the process that makes both its own vinyl plastic film and steel. The process has now been licensed to 17 American manufacturers, including major steel companies, and in 27 foreign countries. Naugatuck Chemical estimates that annual, worldwide production of the laminate will reach 140 million square feet by 1960.

STEPHENS - ADAMSON MFG. CO., Aurora, Ill., has designed a passenger conveyor belt system using a special passenger belt manufactured by The Goodyear Tire & Rubber Co., Akron, O., which will be installed in the new Innovation department store at Lucerne, Switzerland. The 42-inch wide speedramp conveyor belt system will carry up to 7,200 passengers an hour between the basement level and the main floor of the ultra-modern Swiss store. The belt system was recently shipped from Chicago aboard the *S. S. Kaarina,* bound for Europe via the St. Lawrence Seaway.

SOCIETY OF PLASTICS ENGINEERS' Washington-Baltimore Section is sponsoring a Regional Technical (RETEC) Conference on the "Stability of Plastics" in cooperation with the Deterioration Center of the National Academy of Science. The conference is scheduled to be held in Washington, D. C., December 1, in the auditorium of the National Academy of Science. The papers will discuss polymer degradation under the influence of radiation, heat, mechanical stress, etc. Authors wishing to participate should send 200-word abstracts of their original papers on the mechanisms of degradation to Dr. Fred Leonard, Army Prosthetics Laboratory, Walter Reed Medical Center, Washington 25, D. C.

AMERICAN LATEX PRODUCTS CORP., Hawthorne, Calif., has announced a new reinforced rubber webbing for the furniture industry. The new webbing supports chair and sofa cushions in place of conventional spring units. Core of the new webbing is a loose, square woven cotton fabric impregnated with a compounded rubber providing superior strength and longevity. Supplied in standard widths, the ⅛-inch thick material packages in 100-foot rolls for production-line operations as well as custom work. Immediate availability is widespread at the company's facilities in San Francisco, Seattle, Dallas, Houston and Omaha.

L-shaped Rifflestrip chute-lining sections protect chutes from abrasive action of slurries

B. F. GOODRICH INDUSTRIAL PRODUCTS CO., Akron, O., has developed a new chute lining, known as Rifflestrip, to protect steel or wooden chutes from the ravages of abrasive slurries. The Rifflestrip bed is developed from a number of individual L-shaped two-inch strips of pure gum rubber. The strips are placed together with the riser of each L-shaped strip forming a series of parallel ridges across the chute. The strips are nailed to wooden chutes or bolted to metal chutes. The abrasive material immediately fills the grooves between the ridges. Consequently, it runs over itself and has nothing to abrade but itself. Rifflestrip will be sold through the distributors of BFG industrial products.

S. C. JOHNSON & SON, INC., Racine, Wis., maker of "Johnson's Wax," has entered into an agreement with National Patent Development Corp., Washington, D. C., whereby the latter firm will represent a group of its undeveloped patents and processes for commercial exploitation, according to Jess Larson, former Federal Works Administrator and Chief of the War Assets Administration, who is chairman of NPDC. Among the patents covered in the agreement are a new method for waterproofing insulating materials; an anti-corrosive; a rubber-curing process; and many chemical processes dealing with colloids.

CORDUROY RUBBER CO., Grand Rapids, Mich., announces that one of its tires was discovered on a rebuilt 1922 Dort automobile. The tire which has withstood 37 years of wear, friction, heat, and rot, was one of the first semi-balloon tires made and was original equipment on the Dort. A Corduroy Lifetime Guarantee Policy provides that any defects in the tire would have to be made good by the company. It would be a problem, however, to replace the tire inasmuch as the molds were destroyed years ago.

THE GOODYEAR TIRE & RUBBER CO., Akron, O., has been awarded an $800,000 contract by the Army for 166 rolling liquid transporters. The new fuel transporters, called "Rolli-Tankers," will be delivered to the Army transportation supply and maintenance command in St. Louis, Mo. The unusually shaped tire-like containers are 64 inches high and 42 inches wide. Tire capacity is 500 gallons, with a unit capacity of 1,000 gallons. The assembled units are equipped with a tow bar, air brakes and pump.

THE FIRESTONE TIRE & RUBBER CO., Akron, O., has presented a gift of $1,050,000 to the California Institute of Technology for the construction of a new aeronautics laboratory. To be called the Firestone Aeronautical Research Laboratory, the new facility will make possible a major expansion of Caltech's extensive aeronautics program. Studies will be devoted chiefly to missile and aircraft structures at hypersonic speeds; design criteria for solid propellants; flow problems at hypersonic speeds; heat transfer, including melting of surfaces exposed to hypersonic gas streams; theoretical fluid mechanics, aimed at the discovery of fundamental laws applicable to large classes of high-speed flow problems.

CLAPP & POLIAK, INC., New York, N. Y., an exposition management firm, will produce the first Industrial Building Exposition & Congress at the New York Coliseum, December 12-15, 1960. The board of sponsors for the events comprises a group of 28 of the nation's foremost architects and industrial executives, with responsibilities for top management, construction and plant operation. Included are executives of International Business Machines, Du Pont, Pratt & Whitney, Sears Roebuck, American Telephone & Telegraph, Aluminum Co. of America, U. S. Steel, Ford Motor, and Continental Can. The Congress will consider such subjects as planning new construction, financing, modernization of older buildings, new types of construction, layout of equipment, construction materials, selection of sites, and avoidance of maintenance problems. Exhibits will be directed to similar themes.

THIOKOL CHEMICAL CORP.'S reaction motors division, Bristol, Pa., has been awarded a $3.5-million contract for production of the Guardian II prepackaged rocket engine. The prepackaged liquid-type power plant is a recent development in liquid rocket engines for missiles, incorporating tankage, propellants, and thrust chamber in one integrated package ready to be fired as soon as it reaches the field. They will be produced at the division's new facilities at Bristol.

News Briefs

TEXAS BUTADIENE & CHEMICAL CORP., New York, N. Y., has brought on-stream at its plant near Channelview, Tex., facilities for the recovery of propylene. This unit is the first to recover propylene in the effluent from the Houdry butane dehydrogenation process utilized by TB&C in the production of butadiene and butylenes. The propylene, which is recovered in 80% minimum concentration, will be supplied to other petrochemical producers or used as feedstock to TB&C's own aviation alkylate operation.

THE FIRESTONE TIRE & RUBBER CO., Akron, O., announced a price reduction on its passenger-car tires ranging from 5 to 19%, effective July 21. Prices of 14-inch passenger-car tires had the greatest reduction. The company's 14-inch Deluxe Champion, the tire on new automobiles, and the "500," a high-speed tire, were reduced 19%. Fifteen-inch tires in the Deluxe Champion and "500" lines were reduced 15%.

UNITED STATES RUBBER CO., New York, N. Y., has announced a 13-inch low-profile tire, radically new in design and engineered specifically for the compact cars which will be introduced by American automobile manufacturers this fall. The tire, now in production at U. S. Rubber's tire plants, will be original equipment on Chevrolet's new Corvair. The new tire, called the U. S. Royal Low Profile Safety 8, has been engineered to give 50% better tread wear than is normally experienced on large cars, according to the company. It will be produced in sizes to fit all the new compact cars.

PAWLING RUBBER CORP., Pawling, N. Y., has developed a new tough, weather-resistant dock bumper for truck loading platforms which is said to absorb the impact of trucks going 20 miles per hour. The rubber bumper has an I-beam design, and its face can be reinforced with steel plate. The standard section is 12 inches long, but also is available in multiples of six inches up to six feet in length. It can be installed with lag screws.

B. F. GOODRICH INDUSTRIAL PRODUCTS CO., Akron, O., is now manufacturing industrial rubber bands up to six feet long and capable of being stretched to 18 feet for holding lightweight cartons together in piles or on pallets. The new pallet band is designed to be used where heavy steel strapping presently crushes lightweight cartons. Large potential markets for the bands include manufacturers of electric light bulbs, television tubes, fluorescent lamps, X-ray tubes, paper napkins, etc. The bands will not crush cartons, can be used over and over, and are easily positioned by one man.

THE RUBBER MANUFACTURERS ASSOCIATION, INC., service managers committee, New York, N. Y., has published two wall-display posters to promote highway safety and assure satisfactory tire service to motorists. One poster is entitled, "Safety Precautions You Must Observe When Mounting or Demounting Automobile Tires." It pictures the various types of rims in current use and describes and illustrates the fundamental automobile tire mounting and demounting methods, as well as safe inflation procedure. The other poster is entitled, "Why Tires Wear Fast or Fail Early." By photographs, line drawings, and statistical charts it graphically presents the effect upon tire service life of sustained excessive speed, heat, incorrect inflation, and poor driving habits. Single copies of these posters may be obtained without charge from the Association.

SEIBERLING RUBBER CO., Akron, O., announced price reductions of most tires in its passenger-car line, effective July 30. The price cut ranges from 5 to 15%. Included in the price reduction are all the company's 14-inch passenger tires, all winter-type tires, and its "Sealed-Aire" and "Safety" tires in the 15-inch sizes.

ROBBINS FLOOR PRODUCTS, INC., Tuscumbia, Ala., goes international with a new corporation formed for the manufacture and distribution of Robbins vinyl and rubber tile in Canada, and the construction of manufacturing facilities in France. The Canadian firm, known as Robbins Floor Products of Canada, Ltd., is located in Granby, Ont., Canada, where a manufacturing plant and offices are under construction. Start-up is slated for about October 1. In cooperation with the Sté Chimique de Gerland, Paris, France, a new manufacturing plant for the purpose of producing Robbins vinyl and rubber tile is being constructed at Lyons and is scheduled for early fall completion. The Robbins line will be produced and distributed throughout France and some other European countries.

THE GOODYEAR TIRE & RUBBER CO., Akron, O., was host at a recent exhibition of an automobile that has been designed to set a new world's land-speed-record. Named the Thompson Challenger I, the low, sleek quadruple engined car, will be piloted by Mickey Thompson, experienced speed dash and road race driver of El Monte, Calif. Goodyear designed and built the tires that will have to withstand speeds in excess of 400 miles per hour if a new speed mark is to be set. Initial tests to determine the acceleration potential of the car were to be conducted at Edwards Air Force Base, Calif., August 2.

SHELL CHEMICAL CORP.'S synthetic rubber division has installed a cobalt-60 irradiation research unit for use in radiation process studies at its research laboratory, Torrance, Calif. The cobalt source consists of 20,000 curies of radioactive cobalt which emits the gamma radiation necessary for experimental work. The radiation will be utilized in the study of improved rubber and plastics products and the development of radiation-resistant products for use in atomic power plants.

REEVES BROTHERS, INC., Vulcan Plant, Buena Vista, Va., which has worked more than 2,115,000 man-hours without disabling injury in more than three years, since May 3, 1956, has been presented the Award of Merit by the National Safety Council. The Vulcan plant manufactures synthetic rubber and plastic coated fabrics, as well as rubber blankets for offset and news printing.

THE FIRESTONE TIRE & RUBBER CO., Akron, O., has developed a new synthetic rubber compound expected to give motorists 5,000 extra miles for every 30,000 miles of driving. The new rubber, Rubber X-99, has been approved for immediate use in the firm's Premium Quality tire. Drivers will get 15% more mileage out of the new rubber, which also is silent and soft riding, stated the company. The new tread stock resulted from the discovery of a new polymer and the development of advanced compounding techniques.

AMERICAN CHEMICAL CORP., Los Angeles, Calif., has contracted with Scientific Design Co., New York, N. Y., for design and construction of a vinyl chloride unit as Watson, Calif. Construction is expected to begin within 60 days, with completion planned for mid-1960. American Chemical will manufacture ethyl chloride, ethylene dichloride, vinyl chloride monomer, and PVC resins to meet requirements of western plastics processors and chemical manufacturers. Richfield Oil Corp. and Stauffer Chemical Co., parent companies of American Chemical, are providing the basic raw materials for the petrochemical operation.

HOOKER CHEMICAL CORP., Niagara Falls, N. Y., has signed a license agreement with General Electric Co. permitting use of Hooker's HET anydride for hardening or curing of epoxy resins under G-E's United State patent No. 2,744,845. Customers of Hooker's Durez Plastics Division, North Tonawanda, N. Y., in turn, automatically will be granted a free sub-license to harden epoxy resins by this means and will be held free under that patent when HET anhydride is used.

UNITED CARBON CO., INC., has moved its Chicago offices to the Le Mar Building, 47th St. and Willow Springs Rd., La Grange, Ill. New address is P. O. Box 328, and new phone number is Fleetwood 4-4700.

THE B. F. GOODRICH CO. will present to the city of Cadillac, Mich., at no cost, its plant property there. The plant has an appraised value of $280,000. Goodrich suspended operations there in May, 1959, and the plant, with 143,000 square feet of floor space located on 13 acres of land, has been unoccupied since that time. Decision to close the plant was taken by BFG when production of rubber products, principally for the automotive industry, could not be continued there on a competitive basis.

THE FIRESTONE TIRE & RUBBER CO., Akron, O., has announced a 25% reduction in the price of all antique automobile tires and tubes. Simultaneously with the price reduction, the company announced an addition to its widely known line of antique tires—a 37x4½ rib tread tire.

REEVES BROTHERS, INC., New York, N. Y., has developed a new adhesive, Reevestrip Adhesive, for bonding oriented nylon strip to neoprene. The new product can be used with the same equipment that is employed for bonding neoprene to other materials. It is also suitable for bonding nylon strip to nylon strip. Reevestrip, oriented nylon, is used primarily as core material in the manufacture of power transmission and conveyor belts to give greater strength and flexibility to belts. Where neoprene was used in the belt manufacture, a problem had existed until now in bonding it with oriented nylon strip.

UNITED STATES RUBBER CO., New York, N. Y., has announced a new merchandising plan for Royalite, a high-impact thermoplastic manufactured in sheet form, which is said to result in substantial savings on small- and medium-volume orders. It also makes possible quick shipment from open stock of all popular colors, grains, and gages of Royalite. The new plan involves the stocking and prepackaging of shipments, a step believed to be unique in the plastics industry. Price savings average 20%, and orders are shipped from the Chicago plant within 24 hours. Thirty-four of the most popular Royalite selections make up the new Royalite standard warehouse stock category, with volume choices designated as large pack and small pack. Quantities as small as three sheets of 54- by 94-inch Royalite are offered.

RUBBER & TIRE MATERIALS CORP., INC., Dallas, Tex., manufacturer of "Longmile Tread Rubber," is constructing a new plant at Spartanburg, S. C., with start-up planned for approximately January 1. The two plants and numerous branch outlets will enable the company to offer overnight delivery service in nearly all areas except the Far West on most all die sizes and grades of tread rubber, including fast-cure types. Warren R. Phillips, Jr., assistant vice president and son of the president, W. R. Phillips, will be in charge of the Spartanburg operation.

NATIONAL EDUCATION ASSOCIATION COMMISSION ON SAFETY EDUCATION, Washington, D. C., has made announcement of National Student Traffic Safety Conference, designed to enlist the aid of high school students of the nation in an all-out war against traffic accidents. This new approach to the problem of traffic safety was made possible by a grant from The Firestone Tire & Rubber Co., Akron, O. High school students, two from each state, including Hawaii and Alaska, were invited to meet in Kansas City, August 30-September 2, to devise a plan of action they could put into effect in their own schools and communities to help cut down traffic accidents.

BUREAU OF SHIPS, Department of the Navy, Washington, D. C., makes the following announcement: "It is the intent of the Bureau of Ships to change the cost allocation of qualification tests at a Government laboratory for Specification MIL-S-15058(SHIPS), Synthetic Rubber Shaft and Rubber Material For Coating Marine Propellor Shafts. The terminal date for tests in a Government laboratory at Government expense is 31 October 1959. Qualification tests requested after that date will be at the expense of the manufacturer." Copies of this specification may be obtained from the Commanding Officer, Naval Aviation Supply Depot, 5801 Tabor Ave., Philadelphia 20, Pa., Attn: CDS.

RUBBA, INC., New York, N. Y., has introduced a new, non-inflammable adhesive for adhering labels to silicone coated rubber tires. Designated Rubbastix, the new adhesive solves the problem resulting from the use of silicone mold release agents in the manufacturing of tires, to prevent them from sticking to molds, and it also prevents labels from sticking to the tires. Rubbastix is a quick-drying adhesive which will adhere labels to any surface, according to the company. This adhesive is applied by brush, spray or conventional labeling machines. It is available in one-gallon cans, five-gallon cans, and 55-gallon drums.

THE GENERAL TIRE & RUBBER CO. held ground-breaking ceremonies on August 4 for a new $9.5-million tire manufacturing plant at Mayfield, Ky. The new plant, which is the firm's third domestic tire factory, is being built because of greatly increasing highway travel and an anticipated rising demand for more tires. It is designed to be expanded as automobile and truck travel increase. The time of these expansions is dependent upon what Congress does about the highway program, stated M. G. O'Neil, General official. He termed the Congressional delay in providing funds for the nation's $100-billion highway program inexcusable and warned that the program, approved in 1956, must be kept on schedule for the future economic growth and progress of the U.S.A.

BORDEN CHEMICAL CO.'s Resinite plant, North Andover, Mass., has developed a new vinyl electrical insulation sleeving called Resinite EP-93C. The new sleeving is designed to meet the latest revision (B) of Wright Air Development Center Specification MIL-L-7444, a standard adhered to almost universally by manufacturers of air frames and airborne and ground-employed electronic equipment.

THE FIRESTONE TIRE & RUBBER CO., Akron, O., has announced that its new Premium Quality tire is now available with Tyrex cord body. The firm's recently developed tread rubber, X-99, gives this premium tire with either nylon or Tyrex cord 15% more wear, and cornering squeal is reduced to a minimum. Another new feature of the tire is an extremely elastic Silver Safety Seal compounded with Diene, Firestone's polybutadiene rubber.

EMERY INDUSTRIES, INC., Cincinnati, O., has announced a $6-million plant expansion project at its Cincinnati plant which will increase severalfold the existing capacity for production of azelaic and pelargonic acids from oleic acid by ozone oxidation. Azelaic acid found its first major market in the vinyl plastics industries. Dioctyl azelate has found acceptance as a standard low-temperature plasticizer. Pelargonic acid finds considerable utility in the manufacture of resins and polymers.

B. F. GOODRICH INDUSTRIAL PRODUCTS CO., Akron, O., has developed Cutless bearings which are adaptable to small sea craft. Similar bearings have long been used as standard equipment as propellor rubber cushions on many big naval and commercial vessels. The rubber bearings, which in service are lubricated by seawater, are distributed nationally by Lucian Q. Moffitt, Inc., Akron, O.

THE GOODYEAR TIRE & RUBBER CO.'s aviation products division, Akron, O., has expanded its line of collapsible Pillow Tanks from a 50,000-gallon capacity unit to accomodate 200,000 gallons for economical transportation and storage of bulk liquids. The Pillow Tanks are constructed with one or two plies of synthetic rubber-coated nylon. When two plies are used, the outer ply consists of nylon cloth coated on both sides with gasoline-resistant synthetic rubber. The inner ply consists of a similar, but lighter ply of nylon cloth.

THE GEORGIA MARBLE CO.'S calcium products division, Tate, Ga., has opened a sixth plant to increase production of calcium carbonate products. The new modern $100,000 plant, fully automatic, will produce Wingdale White. This product is being produced by dry grinding in tube mills—the first installed in the South—and classified in an air separator. The plant utilizes the finest equipment and houses its own process laboratory to insure uniform quality. The product is well adapted for use in many industries including paint, rubber, plastic, and mastic.

HARDMAN TOOL & ENGINEERING CO., a subsidiary of The Dayton Rubber Co., Dayton, O., is manufacturing strong, lightweight containers which will soon permit luggage removal from jet aircraft in less than three minutes. Using a rigid urethane formulation sandwiched between fiberglass, the tub-shaped containers weigh only 84 pounds, yet can handle jobs well over 1,100 pounds. The containers were developed for the DC-8 Jet Mainliners. The containers are carted to the plane, lifted aboard by an electric hoist. Inside the compartment they fit into place, 11 containers on each DC-8.

MOBAY CHEMICAL CO., Pittsburgh, Pa., a supplier of basic urethane chemicals, reports that markets for urethane foam cushioning materials have more than doubled in the past 12 months. J. D. Mahoney, Mobay director of marketing, stated that sales of urethane materials have been doubling each year since the materials were first introduced commercially here in 1956, and the 75-million-pound market predicted for 1959 now seems assured. For the first time a majority of manufacturers in both the furniture and automobile industries is specifying urethane foams for cushioning in at least a portion of their lines. The sales gain for urethane materials was attributed to a heavy emphasis on technical service and laboratory development work on basic foaming technology which has characterized the urethane market approach from the beginning.

ASSOCIATED GASKETS, INC., has moved to a new plant on Riparian St., Bridgeport 8, Conn., according to V. J. Castaldo, president. The move gives the company three times its previous working space for the manufacture of rubber parts for aviation, missiles, electronics, and other industries. Founded in 1949, Associated Gaskets has grown from a one-employe plant to one that employs 75 people. In 1958 the company purchased the Canfield Rubber Co., in Bridgeport.

THE FIRESTONE TIRE & RUBBER CO., Akron, O., is producing a line of 13-inch tires developed especially for the forthcoming American small cars, in addition to the company's present line of tires for foreign import cars. The new small tires are fully capable of sustained high-speed turnpike travel, according to Firestone. They are being built in plants at Akron, O., Des Moines, Iowa, and Los Angeles, Calif. Sizes in production are 6.00x13 and 6:50x13.

NEWS about PEOPLE

John J. Cullen has been named product manager of engineered and molded rubber products by United States Rubber Co., Passaic, N. J. He will direct sales of various types of molded, extruded, lathe-cut, and continuous molded rubber goods, specialties, rubber-to-metal bondings, and engineered products. Since 1956 he was assistant product manager of engineered and molded rubber products. He will continue to operate out of the Passaic plant's sales department.

George Lenhart has been appointed assistant to the president, The Wilson Rubber Co., Canton, O., a division of Becton, Dickinson & Co., according to **J. W. Simmons,** president. Lenhart also continues his current duties as superintendent, Plant No. 2. Also, **Elwyn H. Becker** has been made chief chemist; **John Yacos, Jr.,** acting superintendent, Plant No. 1; and **William S. Zimmerman,** assistant superintendent, Plant No. 2.

David Anderson becomes production superintendent, petrochemicals, Polymer Corp., Ltd., Sarnia, Ont., Canada, according to **L. D. Dougan,** vice president-operations. Anderson will be responsible for the steam and power plant, feed preparation, and the butadiene and styrene units.

Richard D. Smith has been named manager of synthetic fiber development at the Avon Lake (Ohio) Development Center of B. F. Goodrich Chemical Co. He joined The B. F. Goodrich Co. in 1942 and has been development supervisor since 1952 at Avon Lake.

James W. Hendry will head up the machinery development laboratory being organized in Scottsburg, Ind., by Marbon Chemical Division, Borg-Warner Corp. This laboratory will investigate certain theoretical and practical aspects of the process of injection molding. Hendry previously had been associated with Jackson & Church and with Tube Turns Plastics.

Dean E. Ley has joined the rubber research department of The B. F. Goodrich Research Center, Brecksville, O. **Louis E. Trapasso** joins the Center's chemicals and plastics research department to work on chemicals for plastics and rubbers. Dr. Ley was with Eastman Kodak Co.; while Dr. Trapasso was working for his Ph.D. in organic chemistry at the University of Maryland.

Everett C. Shingleton, product manager of agricultural and industrial tire sales in original-equipment sales, has been named manager of passenger-tire sales for B. F. Goodrich Tire Co., Akron, O. **John E. Jerome,** who was sales representative in original equipment, succeeds Shingleton.

Laurel G. Parkinson, new general manager-marketing, Amoco Chemicals Corp., Chicago, Ill., has been elected a director, according to **J. H. Forrester,** president. Parkinson joined Amoco in 1958 as general sales manager-chemicals, coming from Lever Brothers Co., where he had been manager of the industrial chemicals department since 1954. He also held positions in sales, manufacturing, research, and development at Atlas Powder Co.

News about People

Paul L. Hoffman has joined the pigment sales staff, and **Lloyd R. Bray** has become a technical service representative of the New Jersey Zinc Co., New York, N. Y. Hoffman will represent the company in the metropolitan Philadelphia area. Bray will headquarter at the New York office.

W. C. Douce has been promoted to the newly created position of assistant director, rubber chemicals sales division, Phillips Chemical Co., headquartering in Bartlesville, Okla. Previously he had been district sales manager of Phillips Chemical's New York district plastics sales division. Also, **R. N. Hendriksen** has been promoted to the newly created position of southeastern district manager of the company's rubber chemicals sales division, with his headquarters in Trenton, N. J. Since 1954 he has been technical sales representative at Trenton.

Harold W. Burkett, treasurer, U. S. Rubber Reclaiming Co., Inc., Buffalo, N. Y., has been elected president of the Buffalo Control of the Controllers Institute of America. The following have been elected directors of Institute local controls in their respective areas: **A. M. Adamson,** treasurer, Canadian General-Tower, Ltd., Galt, Ont., Canada (Hamilton Control); **William R. Dice,** vice president, the Eagle-Picher Co., Cincinnati, O.; and **Bruce E. Esterly,** vice president and controller, Cooper Tire & Rubber Co., Findlay, O. (Toledo Control).

Norman G. Gaylord has been elected vice president, research and development, at the polymer division, Western Petrochemical Corp., New York, N. Y. He was formerly assistant director of the organic chemistry department, Interchemical Corp. The new polymer division at Western will have two basic objectives, one immediate, one of somewhat longer range. The first phase will be to explore more fully the potentials of existing wax products. The second phase of the polymer division's development will be creation of new and distinct polymers not necessarily based on wax.

A. N. Stull has been appointed assistant vice president for technical service, Borden Chemical Co., New York, N. Y. Stull, formerly general manager of Borden's coatings and adhesives department, moves to North Andover, Mass., to the company's Resinite vinyl extrusion plant. In his new position, he will work directly with the company's vice president and technical director. **Henry L. Schmidt,** operations manager of Borden's five resins and chemicals department plants and laboratories, succeeds Stull as general manager of the coatings and adhesives department at Peabody, Mass.

F. W. Boggs

S. A. Black

S. A. Black, F. W. Boggs, P. D. Brass, and **E. M. McColm,** four scientists at the United States Rubber Co.'s research center, Wayne, N. J., have been promoted to the newly created position of research associates in recognition of their outstanding ability to do independent creative research. As research associates, they will be on the same organization level as department managers, the highest administrative positions directly concerned with managing industrial research; however, the responsibilities of the research associates will be of a research nature rather than administrative. Dr. Black, a member of the mechanical engineering research staff, is currently working on automation of factory processes. Dr. Boggs is a physicist in the company's synthetic rubber research department and has worked on dielectrics, polyurethanes, tubeless tire liners, and abrasion of rubber. Dr. Brass, a member of the company's latex and plastics research team, is now working on new types of emulsion polymers. Dr. McColm's principal work in recent months has been a study of the methods of improving nylon tire cord, and in this study he has used many of the modern methods of experimental design.

E. M. McColm

P. D. Brass

Edmond S. Bauer becomes assistant director of development for Monsanto Chemical Co.'s plastics division, Springfield, Mass., according to **David S. Plumb,** director of development. Bauer will devote full time to the direction of the program for new products deriving from Monsanto research not directly assigned to the plastics division's marketing department.

Lincoln B. Crosby, manager of Monsanto Chemical Co.'s plastics division plant, Springfield, Mass., since 1953, becomes director of manufacturing, eastern operations, according to **R. K. Mueller,** vice president and division general manager. Crosby replaces **Carl E. Pfeifer,** who has been given an extended leave of absence from the division to accept a special assignment for the company's executive committee, St. Louis, Mo. **Allen G. Erdman** has been named plant manager, replacing Crosby. Erdman had been the division's administrator for vinyl products since 1958.

Arthur W. Fasold has been appointed assistant general sales manager of Hewitt-Robins, Inc., Stamford, Conn. He will assist in policy planning and administration of the company's nationwide sales and engineering organization responsible for marketing belt conveyors, industrial rubber products, power transmission equipment, and vibrating machinery. Fasold had been assistant manager of commercial research and later manager of sales services.

John J. Denbrock becomes assistant to the vice president in charge of plastics, The General Tire & Rubber Co., Akron, O., according to **J. E. Powers,** plastics vice president. Other promotions are: **Wayne Thorne,** to manager of the building materials division; and **Alfred G. Turner** to manager of wall and counter-top material sales. In his new position, Denbrock will work closely with General's Bolta, Textileather, and Jeannette plastics operations on all sales, advertising, and merchandising.

H. E. Humphreys, Jr., chairman of the board of United States Rubber Co., New York, N. Y., will serve as national chairman of the nineteenth annual National Bible Week, October 19-25, according to the Laymen's National Committee, the inter-faith organization which sponsors the special week each October. Humphreys will be aided by more than 100 business executives throughout the country serving as industry chairmen, and by special chairmen for the press, radio, television, and motion picture fields.

Ronald G. Knecht has been named manager of accessories and repair materials sales, Seiberling Rubber Co., Akron, O. **Perry S. Lazich** has been assigned to the accessories and repair materials sales force; while **George D. Lang** has assumed Lazich's former duties as dealer information coordinator. **Lester A. Wood,** a territory sales manager in Seiberling's Kansas City district, has been assigned to the truck tire sales department in Akron as a special sales representative.

News about People

Joseph E. Weldon has been appointed sales representative in the Boston district of the chemical division of The Goodyear Tire & Rubber Co. He joins Goodyear with extensive experience in the compounding and coating industries. In his new post, he will be concerned primarily with the division's sales of latices and resins to the textile and paint industries.

William W. Pedersen, manager of the Dow Corning Corp. Cleveland sales office, is being transferred to the main office, Midland, Mich. He becomes a full-time member of a new corporate planning committee reporting to the president, **W. R. Collings.** This group, which includes **R. W. Caldwell** and **A. W. Rhodes,** will study and make recommendations regarding new product lines and the expansion of existing ones, manufacturing, development, and marketing facilities, plant locations, and other matters. **Max H. Leavenworth,** manager of the southwestern branch in Dallas, is now manager of the Cleveland office. **Edwin Haire** of the Dallas office succeeds Leavenworth as manager there. Pedersen worked for the Dow Chemical Co. from 1938 to 1945, when he joined Dow Corning. He has been head of the Cleveland branch office since it was established in 1946.

Allan W. Cox has been appointed director of urethane product sales for The Dayton Rubber Co., Dayton, O., according to **C. M. Christie,** president. Cox will coordinate sales of all urethane products of all divisions with the exception of pillows and furniture cushioning and will coordinate Dayton Rubber's expanding eastern urethane marketing activities with those of American Latex Products Corp., a wholly owned subsidiary in Hawthorne, Calif.

A. C. Jamison has been appointed sales representative, industrial products, manufacturers' sales division, Firestone Tire & Rubber Co. of Canada, Ltd., Hamilton, Ont., Canada, according to **R. I. Raycroft,** vice president-sales.

M. F. Gillespie, plant manager of The Goodyear Tire & Rubber Co.'s Los Angeles plant since July, 1957, has been appointed manager of European production. Succeeding Gillespie as plant manager is **Charles T. Clark,** production superintendent and assistant to the plant manager at Gadsden, Ala. Gillespie replaces **W. T. Clayton,** who has been assigned to France as the company's new plant manager there. Gillespie will be responsible for production at Goodyear plants in England and Scotland (through the production director of Great Britain), France, Sweden, Luxembourg, and South Africa.


J. E. Weldon   Ray Hurst

Robert S. Johnson, vice president since July, 1957, has been elected a director of The Eagle-Picher Co., Cincinnati, O., effective September 1. **Milo J. Marsh** has been appointed president of The Ohio Rubber Co., a division of Eagle-Picher, succeeding Brigadier General **Hermon F. Safford,** who retires on September 1. Marsh has also been elected a vice president of Eagle-Picher.


M. J. Marsh   C. E. Farnsworth

Earl B. Hathaway has been appointed vice president of all sales for The Firestone Tire & Rubber Co., Akron, O. He will coordinate sales in the six fields in which the company is expanding its activities: rubber, metals, plastics, synthetics, textiles, and chemicals. He had been vice president in charge of trade sales. **Charles L. Largent,** eastern division manager in New York since 1953, was named general trade sales manager, taking over Hathaway's former duties. Hathaway had been trade sales manager of the entire company since 1952. He was elected vice president in 1957.


E. B. Hathaway   R. W. Kugler

Ray Hurst has been transferred from Trenton, N. J., to the Los Angeles, Calif., office of H. M. Royal, Inc., the representative of J. M. Huber Corp. for the sale of carbon black, clays, and chemicals to the rubber industry in the New Jersey area and on the West Coast. Hurst has been associated with Royal at its Trenton headquarters for the past 11 years and with the rubber industry for 20 years.

J. B. Preston becomes sales manager, Seiberling Rubber Co. of Canada, Ltd., Toronto, Ont., Canada, according to **A. P. Acheson,** vice president-sales.

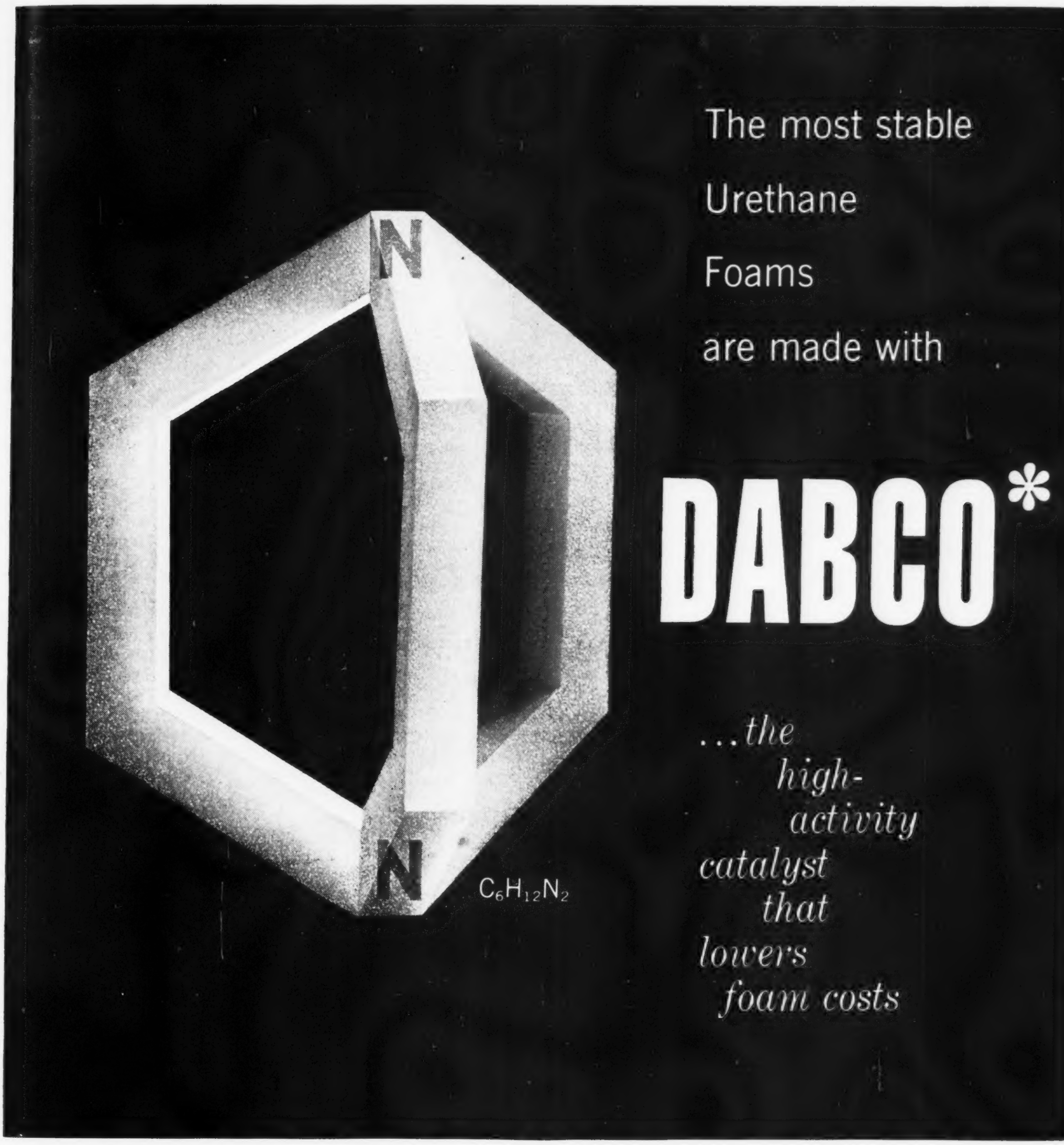
R. D. Gerrie has been added to the board of directors of Francis Shaw & Co., Ltd., Manchester, England. He will continue in office as managing director of Francis Shaw (Canada), Ltd., which manufactures Shaw equipment for Northern America and handles sales for the parent company on the American Continent.

Charles E. Farnsworth has been named product manager-plastics, product management department, Enjay Co., Inc., New York, N. Y. The division, a new one, reflects the increased emphasis Enjay is placing on the plastics field, according to **J. E. Wood, III,** Enjay president. The firm announced its entry last year into the plastics field as a marketer of Escon, an improved polypropylene. In his new assignment, Farnsworth will be responsible for manufacturing coordination, technical service, and transportation and distribution for the plastics division.

G. Bracewell has been named comptroller of Polymer Corp., Ltd., Sarnia, Ont., Canada. Previously he was manager of the company's accounting department. Also, **David Anderson** has been appointed production superintendent, petrochemicals, Polymer Corp. As such, he will be responsible for the steam and power plant, feed preparation, butadiene, and styrene units.

William A. Mullin is now manager of camelback and repair material sales for The General Tire & Rubber Co., Akron, O., according to **L. L. Higbee,** trade sales manager. Mullin succeeds **Floyd A. Yocke,** now Akron division manager.

Rudolph W. Kugler has been named assistant to **George F. Blasius,** president of Cary Chemicals, Inc., East Brunswick, N. J. Kugler's duties will be those of administration and planning. In the past he was a sales representative with Dow Chemical Co. and purchasing agent for Heil Process Equipment Co.



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News about People

L. E. Stanton

J. D. Hunter

R. W. Williams

J. Platner

D. C. Baker

L. E. Stanton, R. W. Williams, J. Platner, and **J. D. Hunter** are affected by a major realinement in the field of sales organization of The Goodyear Tire & Rubber Co.'s chemical division, Akron, O. Stanton, former district manager at Houston, has been transferred to Detroit as district manager, replacing L. P. Thies, recently named manager of the new polyester products department. Williams, former senior sales representative on the West Coast, has been appointed West Coast district manager. In this position he will headquarter at Portland, Oreg., and also maintain offices in Los Angeles and San Francisco, Calif. Platner, former senior sales engineer in the rubber and rubber chemicals department, has been appointed district manager at Houston, replacing Stanton. Hunter, former senior sales representative in the division's Chicago office, has been transferred to the St. Louis office as district manager. He replaces W. E. Kelly, recently made manager of the chemical division's new adhesives department.

George D. Hitler, manager of dealer sales, The Firestone Tire & Rubber Co., Akron, O., has been given the special sales assignment previously held by **James L. Cumming,** now eastern division manager. **Charles H. Hahn** succeeds Hitler as manager of dealer sales. Hahn was western trade sales manager.

William M. Martin has been appointed assistant manager, gasket and packing sales, industrial division, Armstrong Cork Co., Lancaster, Pa., according to **W. B. Tucker,** general sales manager. Martin was formerly a technical assistant in gasket and packing sales. He will share in the overall management responsibility of gasket and packing sales with **A. J. Littlejohn,** manager.

Lee R. Jacobs has been appointed sales manager of industrial products, Acme Backing Corp., headquartering in the firm's St. Louis, Mo., plant. Previously he had been with the textile fibers department of Du Pont in the industrial merchandising section.

William B. Reynolds has been named vice president and director of research of General Mills, Inc., Minneapolis, Minn., according to C. H. Bell, president. Dr. Reynolds, formerly director of research for Phillips Petroleum Co., Bartlesville, Okla., holds a Ph.D. in organic chemistry from the University of Chicago. Since 1946 he has been employed by Phillips, where he first supervised its synthetic rubber program. He became assistant director of research and in February, 1958, was appointed director of research at Phillips.

C. F. Kukula becomes manager of the general methods and standards department at The Firestone Tire & Rubber Co., Akron, O., succeeding the late **R. M. Stacy.** Kukula was manager of the stock preparation department at the company's Plant 2.

Fred Jaffe, Clifton L. Kehr, and **A. D. Ketley** have been assigned to the staff of the Washington Research Center, Clarksville, Md., by the research division, W. R. Grace & Co. The three appointees, research chemists with Ph.D. degrees, will be primarily concerned with polyolefin research.

Bogislav von Schmeling, a research plant pathologist, has joined the agricultural chemical research and development staff of Naugatuck Chemical Division, United States Rubber Co. Dr. von Schmeling has been assigned to the biological research group working at the Division's experimental farm in Bethany, Conn. His research area will be fungicides.

Milton G. Lucke has been named superintendent of Burke Rubber Co.'s atomic rocket missile division, San Jose, Calif., with responsibility for developing new materials for customers engaged in various phases of the Atomic Energy Program. His background includes 20 years with Gates Rubber Co., and an earlier four years with Quaker Rubber; his work entailed development of new products in both technical and supervisory capacities.

Donald C. Baker is now general sales manager of A. Schrader's Son, a division of Scovill Mfg. Co., Inc., headquartering at the firm's main office and plant, Brooklyn, N. Y. He will be responsible for all Schrader sales of merchandise manufactured in the United States. He has been manager of Schrader's Akron, O., branch since 1957, having joined the firm in 1948.

K. J. Whisler has been named assistant manager, automotive jobber sales department, industrial products division of The Goodyear Tire & Rubber Co., Akron, O. The appointment is effective September 1, according to **R. B. Warren,** division general manager. In his new capacity, Whisler will assist in the overall administration of the department, which handles replacement sales of automotive and home appliance belts and hose through a national network of jobber and dealer outlets.

William F. Flower has been appointed sales manager of Crown Rubber Co.'s custom foam products division, Freemont, O. He has served as a sales representative in the foam rubber division of Goodyear Tire & Rubber Co. and as sales manager of the foam rubber division of Collins & Aikman Corp.

P. W. Mitchell has joined Mobay Chemical Co., Pittsburgh, Pa., as manager of technical service for "Merlon" thermoplastic polycarbonate resins. He was formerly a research specialist with Monsanto Chemical Co.'s plastic division. In his new capacity he will head up technical service of "Merlon" resins which Mobay will manufacture at facilities now being built at its plant in New Martinsville, W. Va., which is scheduled for completion early next year.

Paul E. Deal has been made supervisor of tire distribution for B. F. Goodrich Tire Co., a division of The B. F. Goodrich Co., Akron, O. He moves up from the position of regional operating manager for the company at Philadelphia, Pa.

News about People

L. A. Babbitt has been named manager, economic and market analysis, Eastman Chemical Products, Inc., a subsidiary of Eastman Kodak Co. in Kingsport, Tenn. In his new position he will expand economic and market survey studies, which he has done for the past several years for Eastman Chemical Products while an assistant department head in the statistical department of Eastman Kodak.

Frank S. Gran has been elected vice president of The Pantasote Co., New York, N. Y., according to **Hans Wyman,** president. Gran has been with Pantasote since 1947. He worked in the Passaic plant until 1956, when he was transferred to the company's New York office.

George W. Robinson is now manager of the traffic department, Sieberling Rubber Co., Akron, O., succeeding **A. P. Baum,** who has retired after 37 years' service. Robinson had been assistant traffic manager since last February.

Harold Reuben, formerly chief chemist, has been named factory and technical manager of Ace Rubber Products, Inc., Akron, O., which is now embarking on a new cycle of expansion, with a 10,000-square-foot addition nearly ready to start production. Reuben joined Ace in 1956, to enlarge the research and testing laboratories. Prior to that he had been in Youngstown, O., with the Republic Rubber Division of Lee Tire & Rubber Corp.

OBITUARIES

Sherman R. Doner

Sherman R. Doner, technical representative, Manhattan Rubber Division, Raybestos-Manhattan, Inc., died of lung cancer at Riverside Hospital in Boonton, N. J., on August 12.

Mr. Doner attended the University of Colorado and was first employed by the Gates Rubber Co. as a rubber chemist for 17 years prior to joining Raybestos-Manhattan on January 1, 1936. In addition to his work as technical representative he had headed up development work at Raybestos-Manhattan in adapting silicone synthetic rubbers for use in various products.

He was a member of the American Society for Testing Materials and its Committee D-11 on Rubber and of the Society of Automotive Engineers and the joint Technical Committee on Automotive Rubber of ASTM and SAE, where he served as chairman of many subcommittees of these organizations. He was also most recently chairman of ASTM Committee D-24 on Carbon Black. Mr. Doner belonged to the Masonic Order and was a member of the Mountain Lake, N. J., Community Church and Mountain Lake Men's Club.

"Sherm" Doner, as he was known by his many friends and business associates during his 41 years in the rubber industry, had considerable experience in rubber products manufacture and served on technical committees of The Rubber Manufacturers Association, Inc.

The deceased was born in Astoria, Ill., on March 23, 1902.

He is survived by his wife, a daughter, and a sister, as well as two nephews.

Funeral services were held on August 15 at the Joseph Dixon Funeral Home in Boonton, followed by services at Rosedale Crematory, Orange, N. J.

Sherman R. Doner

William W. Gamwell

William W. Gamwell, 61, assistant treasurer of The New Jersey Zinc Co., New York, N. Y., died on August 4 in a New York hospital.

Mr. Gamwell joined the zinc company in 1948, following a long association with the investment business in New York. He served in the Army during World War I and was a lieutenant colonel in the Marine Corps Reserve in World War II. He attended Yale University.

He was a member of the Downtown Association and a director of River View Hospital, Red Bank, N. J.

Surviving are his wife and four daughters.

Rupert T. Cooke

Rupert T. Cooke, 84, died on June 12 at London, England. He made a unique contribution to the growth of Francis Shaw & Co., Ltd., Manchester, and played an important part in the field of engineering for the rubber industry over the past 60 years during its great period of expansion.

He was a director of Francis Shaw & Co., Ltd., for 57 years and chairman for 30 years. He did much in his early days to support the growth of the rubber plantation industry.

In later years, besides traveling extensively in America, where he had many friends, and in other parts of the world, he took active part in the affairs of the institutions and trade associations connected with the rubber and hydraulic engineering industries.

After living for many years in Manchester, he moved to London where he spent the later years of his life.

Rupert T. Cooke

Ralph H. Tyrrell

Ralph H. Tyrrell, one of the veteran rubber manufacturing executives of the industry, who was associated with The Stalwart Rubber Co., Bedford, O., for the last 27 years, died suddenly on July 30.

Obituaries

He was born in North Ridgeville, O., on April 11, 1883. He went to Cleveland 16 years later to work for The Mechanical Rubber Co. He rose rapidly in the organization of that company until he reached the position of general superintendent. When Mechanical Rubber was purchased by United States Rubber Co. and its operations moved to Passaic, N. J., he worked briefly for The National Screw & Mfg. Co., Cleveland, O.

Later he joined The Aetna Rubber Co. until that company closed its Cleveland plant and moved to Ashtabula, O. He then went to The Ohio Rubber Co., Willoughby, O., but later returned to Cleveland with the R. H. Schwartz Rubber Co.

In June, 1932, Mr. Tyrrell became associated with The Stalwart Rubber Co., serving as vice president and a director. He had the responsibility of chief chemist, compounding rubber compounds to meet the critical specifications of the many industries that company serves. In 1957 he retired from active duty with Stalwart, but continued in a consulting capacity until his death.

Funeral services were held August 3 at the Maher Funeral Home, Cleveland.

Mr. Tyrrell is survived by his widow, two sons, four grandchildren, and one sister.

Kenneth E. Kress

Kenneth E. Kress, supervisor of methods development in the analytical laboratory at The Firestone Tire & Rubber Co., Akron, O., died July 15 after a long illness.

Mr. Kress started with Firestone as a chemical engineer in the laboratory in 1944 and was named supervisor in 1953. In his work he dealt mostly with the development of analytical methods for rubber products and compounding ingredients. During his career with Firestone he presented several technical papers and had eight papers published in technical magazines.

The deceased was born in Drake County, O., 36 years ago. He was graduated from Ohio State University with a bachelor's degree in chemical engineering and later received his master's degree from the University of Akron.

Mr. Kress was a member of the American Chemical Society and its Rubber Chemistry and Analytical Chemistry divisions, The Society for Applied Spectroscopy, the Akron Rubber Group, and the National Fraternal Society of the Deaf.

He is survived by his wife, a son, and three daughters.

CALENDAR of COMING EVENTS

September 13-18
American Chemical Society. 136th National Meeting. Atlantic City, N. J.

September 18
Chicago Rubber Group. Furniture Club, Chicago, Ill.

September 24
Fort Wayne Rubber & Plastics Group.

October 2
Detroit Rubber & Plastics Group, Inc. Detroit Leland Hotel, Detroit, Mich.
Philadelphia Rubber Group. Poor Richard Club, Philadelphia, Pa.

October 6
The Los Angeles Rubber Group, Inc. Biltmore Hotel, Los Angeles, Calif.

October 8
Southern Ohio Rubber Group. Gibbons Hotel, Dayton, O.

October 9-10
Southern Rubber Group. Hotel Peabody, Memphis, Tenn.

October 13
Buffalo Rubber Group. Hotel Westbrook, Buffalo, N. Y.

October 16
New York Rubber Group. Henry Hudson Hotel, New York, N. Y.
Boston Rubber Group. Hotel Somerset, Boston, Mass.

October 23
Akron Rubber Group. Sheraton Hotel, Akron, O.

October 26-28
Ninth Canadian High Polymer Forum. Guild Inn, Toronto, Ont., Canada.

October 26-31
International Standards Organization Technical Committee 45 on Rubber. Henry Hudson Hotel, New York, N. Y.

November 5
Rhode Island Rubber Club. Fall Meeting. Pawtucket Country Club, Pawtucket, R. I.

November 6
Philadelphia Rubber Group. Fall Dance. Manufacturers Golf & Country Club.
Chicago Rubber Group. Furniture Club, Chicago, Ill.
Connecticut Rubber Group.

November 9-13
International Rubber Conference. Division of Rubber Chemistry, ACS; Committee D-11, ASTM; Rubber & Plastics Division, ASME. Shoreham Hotel, Washington, D. C.

November 29-December 4
American Society of Mechanical Engineers. Annual Meeting. Chalfonte-Haddon Hall, Atlantic City, N. J.

December 1
SPE Washington-Baltimore Section. Regional Technical Conference on "Stability of Plastics." Auditorium, National Academy of Science, Washington, D. C.

December 1-3
Eighth Annual Wire & Cable Symposium, Berkeley-Carteret Hotel, Asbury Park, N. J.

December 3
Fort Wayne Rubber & Plastics Group.

December 3-5
American Chemical Society. Southwest Regional Meeting. Capitol House, Baton Rouge, La.

December 8
Buffalo Rubber Group. Christmas Party. Buffalo Trap & Field Club, Buffalo, N. Y.

December 11
Detroit Rubber & Plastics Group. Christmas Party. Hotel Statler, Detroit, Mich.
Boston Rubber Group. Christmas Party. Hotel Somerset, Boston, Mass.

December 12
Southern Ohio Rubber Group. Christmas Party. Miami Valley Country Club, Dayton, O.

December 18
New York Rubber Group. Christmas Party. Henry Hudson Hotel, New York, N. Y.

January 29
Akron Rubber Group. Sheraton Hotel, Akron, O.

February 1-5
American Society for Testing Materials. Committee Week. Hotel Sherman, Chicago, Ill.

February 2
The Los Angeles Rubber Group, Inc. Biltmore Hotel, Los Angeles, Calif.

February 5-7
Boston Rubber Group. Ski Week-End.

February 11
Fort Wayne Rubber & Plastics Group.

February 19
Connecticut Rubber Group.

For drying rubber and rubber-like materials

you get – LESS DRYING TIME

LESS "DRYING SPACE"

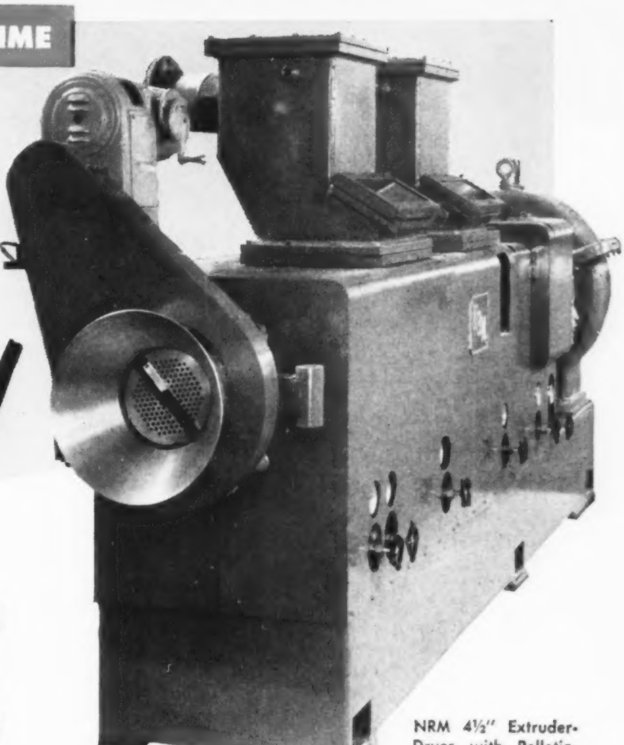
LESS CONTAMINATION

LESS MAINTENANCE

with the NEW

NRM

EXTRUDER-DRYER



NRM 4½" Extruder-Dryer with Pelletizing Die. Sheet Dies may also be used on the Extruder-Dryer.

The Extruder-Dryer is NRM's answer to the rubber industry's need for a faster, more reliable and more space-saving method of drying natural and synthetic rubbers, and dielectric rubber stocks. The machine is a single screw devolatilizing extruder with a three-section cylinder. Stock from the coagulator is fed into the first section where a new-type feed screw reduces moisture to as low as 5%. In the second section, stock is metered through an adjustable choke into a multi-stage devolatilizing area where remaining moisture is flashed off under vacuum. The third section forwards the rubber to the die.

The die may be a perforated plate with rotating cutter blade for pelletizing the dried stock, or a sheeting die.

The NRM Extruder-Dryer is designed to eliminate the complicated equipment of conventional rubber drying methods, their maintenance and contamination problems and excessive floor space requirements, yet provide highly efficient drying. The drying ability of the Extruder-Dryer is below ½ of 1% total moisture at compatible extrusion rates.

Let us discuss your rubber de-watering requirements and recommend the right type and size NRM Extruder-Dryer to do your work most efficiently and economically.

2984

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EXPORT: Gillespie & Company, 96 Wall St., New York 6, N. Y.

MARKET REVIEWS

Natural Rubber

During the first part of the period under review (July 16-August 15) the natural rubber market continued to advance with the lead often taken by New York. Good support here has been in evidence. United States buyers have also been prominent customers in the Singapore market.

Some new business with the Continent and East European countries has been placed in London, and in the Far East, in particular by Russia and China, although buying in Singapore by the latter country is believed to have been moderate. The demand is almost all for early deliveries, which is causing an increasing tightness of nearby rubber.

The temporary cessation of the U. S. stockpile rotation has added to the present difficulty, which has caused values of the nearer positions in all three markets to go to a premium. Also, there have been some offerings—though so far not in great volume—of forwards by producers, who want to take advantage of the present high price level. The result has been a widening to a greater degree of the difference between near and forward positions.

The Washington meetings on the stockpile rotation policy reportedly caused only a slight degree of uneasiness in the market. A clarification of the stockpile question is still awaited by the markets, and opinions appear to be divided as to the final outcome. Recent increased buying interest by the larger American manufacturers might suggest that they do not anticipate any immediate release of larger quantities from the stockpile.

Consumption of natural rubber continues to be greater than supply; so rubber prices seem likely to be substantially higher this fall: 36-37¢ at the first level, and if this is exceeded, the 41-42¢ area.

Revised estimates show consumption of natural rubber for 1959 at 2,120,000 long tons, compared to production of 1,960,000 tons. Another important factor is the 40% decline in open interest contracts which started last spring after the 4¢ drop from the 37-38¢ area. This is double the seasonal decline and puts the market in sound internal condition with the anticipation of higher prices for long-term trading.

July sales, on the New York Commodity Exchange, amounted to 15,350 tons, against 15,310 tons for June contract. There were 22 trading days in July, and 22 during the July 16-August 15 period.

On the physical market, RSS #1, according to the Rubber Trade Association of New York, averaged 36.45¢ per pound for the July 16-August 15 period. Average July sellers' prices for representative grades were: RSS #3, 34.81¢; #3 Amber Blankets, 34.50¢; and Flat Bark, 30.03¢.

Synthetic Rubber

Total new rubber consumption in July at 143,135 long tons exceeded June's 139,481, with synthetic rubber's 94,985 tons in July topping the 91,695-ton June figure also, according to the regular monthly report of The Rubber Manufacturers Association, Inc.

Consumption by types in July, as compared with June, in long tons was variable, as follows: SBR, 80,140, against 76,065; neoprene, 6,030, against 7,083; butyl, 6,135, against 5,484; and nitrile, 2,680, against 3,063.

Exports remained at a high level of 28,083 tons for all types.

Trends in SBR masterbatches, which are of more than usual interest these days, showed the oil-black masterbatch production up to 18,939 tons in July from 13,843 tons in June on a gross rubber basis. Carbon black masterbatches in contrast dropped to 3,731 tons in July, as compared with 5,853 in June on the same basis. The oil extended rubber production rose almost 3,000 tons in July over June also.

With total new rubber consumption for seven months of this year at 938,597 long tons, of which 613,152 tons were synthetic, a 1,600,000-ton year seems assured unless the entire economy is slowed down by a continued steel strike.

Latex

The drum latex market was quiet during the July 16-August 15 period. Apart from some small covering by consumers to meet their immediate requirements, only a limited amount of business was reported. On the other hand, the bulk latex market remains very steady, and the differential has hardened.

Malayan shipments in June amounted to 9,912 tons, compared with 10,462 in May, bringing the total for the first half of 1959 to 61,227 tons, against 56,756 in the same period last year.

Consumption in the United States in June reached 5,970 tons, compared with 5,429 tons in May, giving a total consumption for the first six months of 1959 of 37,917 tons, against 32,202 tons during the same period in 1958.

Prices for ASTM centrifuged concentrated natural latex, in tank-car quantities, f.o.b., rail tank car, ran about 45.03¢ per pound solids. Synthetic latices prices were 26.0 to 40.25¢ for SBR; 37 to 57¢ for neoprene; and 45 to 60¢ per pound for the nitrile types.

Final May and preliminary June domestic figures for all latices were

REX CONTRACT

	July 17	July 24	July 31	Aug. 7	Aug. 14
July	34.75	35.80	....	....	....
Sept.	34.75	35.05	37.00	38.00	39.40
Nov.	34.35	34.75	35.90	36.30	37.10
1960					
Jan.	34.05	34.20	35.35	35.65	35.95
Mar.	33.75	34.05	35.04	35.30	35.45
May	33.60	33.90	34.90	35.10	35.00
July	33.50	33.80	34.80	35.00	34.60
Sept.	....	....	34.70	34.90	34.50

NEW YORK OUTSIDE MARKET

	July 17	July 24	July 31	Aug. 7	Aug. 14
RSS #1	35.00	35.38	37.00	38.13	38.75
#2	34.88	35.25	36.88	37.88	38.38
#3	34.63	35.13	36.63	37.63	38.00
Pale Crepe					
#1 Thick	37.00	37.38	38.50	40.25	41.00
Thin	36.50	36.88	38.00	39.25	40.25
#3 Amber Blankets	34.25	35.50	36.50	37.50	38.25
Thin Brown Crepe	33.88	35.13	36.13	37.13	37.88
Standard Flat Bark	29.75	30.50	31.63	32.75	33.38

CYANAMID RUBBER **Chem Lines**

NO. 24 OF A SERIES   Published by AMERICAN CYANAMID COMPANY, Rubber Chemicals Department, Bound Brook, New Jersey

ANTIOXIDANT 2246®— a non-staining and powerful antioxidant

The commercial success of Antioxidant 2246 is primarily due to its marked superiority in antioxidant activity and its non-staining character. Tests have consistently shown it to also provide excellent non-discoloring properties.

The use of Antioxidant 2246 is natural and synthetic molded white and pastel goods is well established. Its superiority has been shown by use of oxygen bomb, air bomb and oven creep tests. Data on % original tensile retained by rubber compounded with Antioxidant 2246, compared to the same recipe with other *equal* cost non-stainers, are shown in Figure 1. The actual recipe used was:

Pale Crepe	100 parts
Calcium Carbonate	60
Unitane® O-220	20
Zinc Oxide	5
Stearic Acid	1.0
Sulfur	3.0
MBTS	1.0
Antioxidant	As shown

Cured at 153°C

A fact that is often overlooked, however, is the relationship of Antioxidant 2246 activity to many of the powerful staining antioxidants used in black goods. Repeated tests have shown it to have equal antioxidant activity as good staining type antioxidants. Thus, throughout the years, a variety of industrial uses for Antioxidant 2246 have developed in which the compounder required a non-discoloring antioxidant but did not wish to sacrifice any antioxidant protection.

In certain black goods uses, transfer staining cannot be tolerated due to discoloration of the surface that is or will come in contact with the rubber. Antioxidant 2246 is used to replace the "stainer" on the basis of equivalent activity. Figure 2 shows that Antioxidant 2246 compares favorably with strong staining type antioxidants.

FIGURE 1

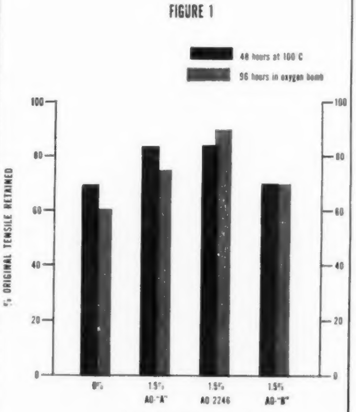
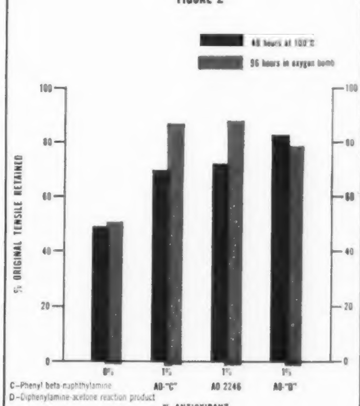


FIGURE 2



Base Compound

Smoked Sheets	100 parts
Keystone Whiting	70
Hard Clay	9
SRF Black	8
EPC Black	2
Medium Process Oil	3
Zinc Oxide	5
Sulfur	2.25
MBTS	0.5
DPG	0.4
Antioxidant	As shown

Cure at 141°C (286°F)

Consequently, the compounder can be assured that whenever his black compound requires a non-stainer, he can use Antioxidant 2246 without sacrificing antioxidant protection.

Other Applications for Antioxidant 2246

In the development of various high-temperature elastomer compounds, Antioxidant 2246 is used for its high level of antioxidant activity coupled with a very low order of volatility.

Antioxidant 2246 also finds use as a gel inhibitor for SBR and prevents the depolymerization of natural rubber under conditions of high-temperature mastication. It also finds extensive use as a stabilizer in various synthetic elastomers.

Dispersions of Antioxidant 2246 give excellent protection to natural and SBR latices, such as 2002 and 2105, for the rug and upholstery backing industry. Antioxidant 2246 also improves the aging characteristics of foam rubber.

In cured latex film work, it has been shown by tensile, oven creep, stress relaxation where applicable, and oxygen bomb tests that Antioxidant 2246 provides maximum protection with a minimum of discoloration. Hence, it is used throughout the latex rubber goods industry.

Where the requirement is for a powerful and non-staining, non-discoloring antioxidant, contact your Cyanamid Rubber Chemicals salesman for information on Antioxidant 2246 relative to your end use or write directly to:

AMERICAN CYANAMID COMPANY
Rubber Chemicals Department
Bound Brook, New Jersey

reported by the United States Department of Commerce as follows:

(All Figures in Long Tons, Dry Weight)

Type of Latex	Production	Imports	Consumption	Month-End Stocks
Natural				
May	0	6,007	5,429	9,718
June	0	*	5,622	11,063
SBR				
May	6,583	—	5,962	7,917
June	6,730	—	6,497	7,314
Neoprene				
May	1,146	0	995	1,417
June	1,223	0	910	1,601
Nitrile				
May	1,156	0	1,112	2,398
June	1,196	0	1,150	2,452

* Not available yet for period covered.

Scrap Rubber

Summer influences were very much at work in the scrap rubber market during the latter part of the July 16-August 15 period, according to one source. Many reclaimers were shut down for annual vacations or preparing to do so, so that they were curtailing intake of scrap. Pricewise, despite the slackening of activity, there were no changes.

Consumption of scrap rubber for June reached 23,830 long tons, bringing the first six months' total for 1959 to 134,072 long tons.

	Eastern Points (Per Net Ton)	Akron, O. (Per Net Ton)
Mixed auto tires	$7.00	$12.50
S. A. G. truck tires	nom.	17.00
Peeling, No. 1	nom.	26.00
2	nom.	22.00
3	nom.	19.00
Tire buffings	nom.	nom.
	(¢ per Lb.)	
Auto tubes, mixed	3.25	3.25
Black	5.75	5.75
Red	6.25	6.25
Butyl	4.75	4.75

Reclaimed Rubber

For the first six months of 1959, total reclaim sales reached 145,733 long tons. This is an increase of 22.4% over the 119,118 long tons for the same period in 1958.

The July 16-August 15 period was, as in previous years, lower in consumption of reclaim than the preceding months. The vacations, however, have been so staggered by the large consumers of reclaim, reports one reclaimer, that no great drop in sales has occurred.

Another reclaimer reports that his firm has been extremely busy during the period under review as it is trying to get caught up after the rubber industry strike. For this reclaimer, business continues good, and the firm has been forced to run some seven-day weeks. Its current orders indicate that the reclaimed rubber business is going to be good for some time to come.

According to The Rubber Manufacturers Association, Inc., report, July production of reclaimed rubber was 28,000 long tons; while consumption was 24,690 long tons.

RECLAIMED RUBBER PRICES

Whole tire, first line	$0.11
Third line	.1025
Inner tube, black	.16
Red	.21
Butyl	.14
Light carcass	.22
Mechanical, light-colored, medium gravity	.155
Black, medium gravity	.085

The above list includes those items or classes only that determine the price basis of all derivative reclaim grades. Every manufacturer produces a variety of special reclaims in each general group separately featuring characteristic properties of quality, workability, and gravity, at special prices.

Industrial Fabrics

Continued healthy demand for wide industrial fabrics, particularly from the automotive and laminating trades, has created a very tight supply situation on a number of constructions, particularly broken twills, during the July 16-August 15 period. Some broken twills, for example, are now completely sold up through the third quarter, with additional business taking place through the final period of the year.

So far as the automotive trades are concerned, the demand has been particularly strong for quick deliveries, with the industry stepping up preparations for going into production on its 1960-model cars.

Along with this demand, there is also evidence of more interest stemming from the laminating trades servicing such manufacturing fields as house trailers and motor boats.

While demand itself has been strong, the actual volume of business transacted during this period has been limited, mainly because of the inability of mills to supply those fabrics particularly in demand. The result finds some mills reporting that this period has been the quietest since the start of the year.

One group of industrial fabrics that have developed a slightly weaker undertone recently has been the wide drills, with reports that some sources have been shading quotations as much as ½¢ a yard. In some respect, there have been some quantities of these fabrics offered in the market by second-hand sources for about ½¢ under quoted levels, with such offerings moving rapidly.

Generally, however, the overall view is that the wide industrial fabrics market is displaying a fairly firm price tone.

Industrial Fabrics

Broken Twills*		
54-inch, 1.14, 76x52 ... *yd.*	$0.52	
58-inch, 1.06, 76x52	.585	
60-inch, 1.02, 76x52	.5825	
Drills*		
59-inch, 1.85, 68x40 ... *yd.*	.385	
2.25, 68x40	.325	
Osnaburgs*		
40-inch, 2.11, 35x25 ... *yd.*	.2275	
3.65, 35x25	.1525	
59-inch, 2.35, 32x26	.295	
62-inch, 2.23, 32x26	.305	
Ducks		
Numbered Duck†		
List less 45%		
Enameling Ducks*	S. F	D. F.
38-inch, 1.78 yd.	$0.3263	.3313
2.00 yd.	.275	.28
51.5-inch, 1.35 yd.	.45	.47
57-inch, 1.22 yd.	.4838	.50
61.5-inch, 1.09 yd.	.5413	.5538
Hose and Belting Duck*		
Basis ... *lb.*	.60	
Army Duck†		
52-inch, 11.70 oz., 54x40 (8.10 oz./sq.yd.) ... *yd.*	.5925	
Sheeting*		
40-inch, 3.15, 64x64 ... *yd.*	.2175	
3.60, 56x56	.185	
52-inch, 3.85, 48x48	.235	
57-inch, 3.47, 48x48	.245	
60-inch, 2.10, 64x64	.365	
2.40, 56x56	.3275	
Sateens*		
53-inch, 1.12, 96x60 ... *yd.*	.6275	
1.32, 96x64	.56	
57-inch, 1.04, 96x60	.615	
58-inch, 1.02, 96x60	.68	
1.21, 96x64	.61	
Chafer Fabrics*		
14.40-oz./sq.yd. P.Y. ... *lb.*	.71	
11.65-oz./sq.yd. S.Y.	.61	
10.80-oz./sq.yd. S.Y.	.65	
8.9-oz./sq.yd. S.Y.	.67	
40-inch, 2.56, 35x25	.25	
60-inch, 1.71, 35x25	.435	

*Net 10 days.
†2% 10 days.

Rayon and Nylon

During the July 16-August 15 period Industrial Rayon Corp., Cleveland, O., announced that the production of Tyrex viscose tire yarn is scheduled to rise considerably by the end of the year. The firm expects to have its Cleveland plant completely converted from regular rayon tire yarn to the new higher-strength Tyrex type by 1960, and a further increase in Tyrex viscose cord capacity has been approved and should be substantially completed by the end of the year.

With increased supplies of this improved viscose tire rayon becoming available, greater use of this product

(Continued on page 934)

Synthetic Rubbers and Latices*

Monomers

11-80, 100, 200, 112-3 Triols	lb.	$0.255	
11-300	lb.	.265	
-400	lb.	.325	
Acrylonitrile	lb.	.27	
Butadiene	lb.	.15	
Dow Styrene	lb.	.12	
H99, N99	lb.	.205	
RG	lb.	.17	
Vinyltoluene	lb.	.17	
EGD	lb.	1.75	/ $2.00
Hylene M	lb.	1.25	/ 2.75
M-50	lb.	.86	/ 2.36
T	lb.	.90	/ 2.46
TM	lb.	.75	/ 2.31
-65	lb.	.80	/ 2.36
Isobutylene	gal.	.38	
Isoprene	lb.	.25	
Mondur-C	lb.	1.05	
Monomer MG-1	lb.	1.00	/ 1.25
-S	lb.	.85	
MPL	lb.	1.75	/ 2.00
Multron R-2	lb.	.54	
P200	lb.	.23	
Rohm & Haas ethyl acrylate	lb.	.34	/ .36
Glacial methacrylic acid	lb.	.40	/ .425
Methyl acrylate	lb.	.37	/ .39
Methacrylate	lb.	.29	/ .31

Shortstops

DDM	lb.	.88	/ .915
Mercaptan 174	lb.	.38	/ .50
Sharstop	lb.	.33	/ .37
268	lb.	.52	/ .53
Tecquinol	lb.	.825	/ .845
Thiostop K	lb.	.50	/ .53
N	lb.	.38	/ .47
Vulnapol KM	lb.	.52	/ .56
NM	lb.	.38	/ .42
Wingstop B	lb.	.38	

Acrylic Types

Acrylon BA-15	lb.	1.25[a]	
EA-5	lb.	1.00[a]	
Hycar 4021		1.34[c]	/ 1.35[c]

Latices

Hycar 2600X30, 2600X39, 2601	lb.	.50	/ .56

Butadiene Types (BR†)

Cis-1	lb.	.35[b]	/ .50[b]

Cold BR Latex

Pliolite Latex 2104	.325	

Fluorocarbon Types

Kel-F Elastomer	lb.	15.00	/ 16.00
5500, 820 (Latex)	lb.	15.00	/ 17.15
Viton A, AHV	lb.	15.00	

Isobutylene Types

Enjay Butyl 035, 065, 150, 215, 217, 218	.23[a]	
165, 268, 325, 365	.24[a]	
Hycar 2202	.65[c]	/ .75[c]
Polysar Butyl 100, 200, 300 400	.245[c]	
101	.2775[a]	
301	.255[c]	
Vistanex LM	.45[a]	
MM	.35[a]	

Neoprene Types (CR)

Neoprene Type AC, AD, CG	.55[a]	/ .575[a]
FB	.65[a]	/ .675[a]
GN, GN-A, WX	.41[a]	/ .435[a]
GRT, S	.42[a]	/ .445[a]
KNR	.75[a]	/ .775[a]
W, WHV	.39[a]	/ .415[a]
WRT	.45[a]	/ .475[a]

Latices

Neoprene Latex 571, 842-A	.37[a]	/ .47[a]
572	.39[a]	/ .49[a]
60, 601-A	.40[a]	/ .50[a]
635	.41[a]	/ .51[a]
650	.42[a]	/ .52[a]
735, 736	.38[a]	/ .48[a]
750	.39[a]	/ .49[a]
950	.47[a]	/ .57[a]

Nitrile Types

Butaprene NF		.49[b]
NH		.65[b]
NL		.50[b]
NXM		.58[b]
Chemigum, N1NS		.64[b]
N3NS, N5		.58[b]
N6, N-6B, N7, N8		.50[b]
N600		.50[b]
Hycar 1001, 1041	$0.58[c]	/ $0.59[c]
1002, 1042, 1043, 1052, 1053, 1312	.50[c]	/ .51[c]
1014	.60[c]	/ .61[c]
1072	.64[c]	/ .65[c]
1411	.62[c]	/ .63[c]
1432, 1441	.59[c]	/ .60[c]
Paracril, AJ		.485[c]
B, BJ, BJLT, BLT		.51[c]
C, CLT		.59[c]
CV		.60[c]
D		.65[c]
18-80		.60[c]
Polysar Krynac 800, 802, 803		.50[c]
801		.58[c]

Latices

Butaprene N-300		.46[b]
N-400, N-401		.54[b]
Chemigum 200		.49[b]
235 CHS, 236		.54[b]
245 B, 245 CHS, 246, 247, 248		.46[b]
Hycar 1512, 1552, 1562, 1577	.45[c]	/ .52[c]
1551, 1561, 1571	.53[c]	/ .60[c]
1852	.46[c]	/ .52[c]
Nitrex 2612	.45[a]	/ .52[a]
2616	.53[a]	/ .60[a]
2619	.52[a]	/ .59[a]
2620, 2625	.45[a]	/ .52[a]
Tylac 640	.45[c]	/ .52[c]
740	.49[c]	/ .56[c]
840	.53[c]	/ .60[c]
1640	.54[c]	/ .61[c]

Polyethylene Type

Hypalon 20, 30	lb.	.70	/ .7275

Polysulfide Types

Thiokol LP-2, -3, -31, -32, -33		.96[a]
-8		1.35[a]
-205		4.00[a]
Type-A		.50[a]
FA		.69[a]
ST		1.25[a]

Latices

Thiokol Latex (dry wt.)		
Type MX		.80[a]
WD-2		1.25[a]
-6	.80[a]	/ 1.25[a]

Silicone Types

GE (compounded)	2.29[c]	/ 4.90[c]
Silicone gum (not compounded)	3.85[c]	/ 4.55[c]
Silastic (compounded)	2.95[b]	/ 3.50[b]
(Partly compounded)	3.15[b]	/ 3.60[b]
(Uncompounded)	4.05[b]	/ 4.35[b]
LS-53	16.00[b]	/ 4.35[b]
Union Carbide (compounds)	2.35[b]	/ 3.20[b]
(Gums)	3.85[b]	/ 4.25[b]

Styrene Types

Hot SBR‡

Ameripol 1000, 1001, 1006, 1007	.24[c]	/ .247[c]
1002	.2435[c]	/ .2495[c]
1006 Crumb	.2475[c]	/ .2535[c]
1009	.2475[c]	/ .2535[c]
Crumb	.259[c]	/ .265[c]
1011	.2475[c]	/ .2535[c]
1012	.2425[c]	/ .2485[c]
Crumb	.249[c]	/ .255[c]
1013	.241[c]	/ .247[c]
Crumb	.2615[c]	/ .2675[c]
ASRC 1004, 1006	.241[c]	/ .2475[c]
1009	.2475[c]	/ .2535[c]
1018	.27[c]	/ .276[c]
1019	.265[c]	/ .271[c]
Copo 1006	.241[c]	/ .247[c]
FR-S 1000, 1001, 1004, 1006	.241[c]	/ .247[c]
1007	.241[c]	/ .247[c]
1009	.2475[c]	/ .2535[c]
1010	.26[c]	/ .266[c]
1012	.2425[c]	/ .2485[c]
1013	.241[c]	/ .247[c]
Crumb	.2615[c]	/ .2675[c]
1014	.281[c]	/ .287[c]
141	.28[c]	/ .286[c]
181	.241[c]	/ .247[c]
Naugapol 1016, 1019	.265[b]	/ .27[b]
1018	.27[b]	/ .275[b]
1021	.30[b]	/ .305[b]
1022	.28[b]	/ .285[b]
1023	.285[b]	/ .29[b]
6003	.27[b]	/ .275[b]
Philprene 1000, 1001, 1006, 6701	.241[b]	/ .247[b]
1009	.2475[b]	/ .2535[b]
1018	.27[b]	/ .276[b]
1019	.265[b]	/ .271[b]
Plioflex 1006	.241[c]	/ .247[c]
Polysar S-630	.241[c]	/ .247[a]
S-X-371	.255[c]	/ .261[c]
S-1000, -1006, -1013		.23[a]
-1002, -1011		.2325[a]
-1009		.24[a]
Synpol 1000, 1001, 1006, 1007, 1061	.241[b]	/ .247[b]
1002	.2435[b]	/ .2495[b]
1012	.2425[b]	/ .2485[b]
1009	.2475[b]	/ .2535[b]
8000	.241[b]	/ .247[b]
X-274	.255[c]	/ .261[c]

Hot SBR Black Masterbatch

Philprene 1100		$0.194
1104		.190[b]
S-1100		.185[a]

Cold SBR

Ameripol 1500, 1501, 1502, 4600	$0.241[c]	/ .247[c]
ASRC 1500, 1502	.241[c]	/ .247[c]
1503	.2625[c]	/ .2685[c]
3105, 3106	.241[c]	/ .247[c]
3110	.26[c]	/ .266[c]
C-102		.23[a]
Copo 1500, 1502	.241[c]	/ .247[c]
1505	.261[c]	/ .267[c]
FR-S 1500, 1502, 146, 179	.241[c]	/ .247[c]
127	.26[c]	/ .266[c]
Gentro 1500		.241
Naugapol 1503	.2625[b]	/ .2675[b]
1504	.295[b]	/ .30[b]
6100	.31[b]	/ .315[b]
Philprene 1500, 1502	.241[b]	/ .247[b]
1503	.2625[b]	/ .2685[b]
Plioflex 1500C, 1502, 1507, 1508X	.241[c]	/ .247[c]
Polysar Kryflex 200		.251[c]
252		.27[c]
Krylene NS		.241[a]
SS-250, SS-250-Flake		.2875[c]
S-1500, S-1502		.23[a]
-1506		.25[a]
Synpol 1500, 1502, 1551	.241[b]	/ .247[b]

Cold SBR Black Masterbatch

Ameripol 4650	.182[c]	/ .188[c]
4651	.177[c]	/ .183[c]
4652	.1425[c]	/ .1485[c]
4654	.187[c]	/ .193[c]
4655	.182[c]	/ .188[c]
Baytown 1600, 1601, 1602		.193[b]
CB-102		.185[a]
Gentro-Jet 9152		.208
9153		.182
9154		.1845
Philprene 1601	.193[b]	/ .199[b]
1603	.194[b]	/ .200[b]
1605	.19[b]	/ .196[b]
S-1600, -1602		.1825[a]
-1605		.18[a]
Synpol 8150	.193[b]	/ .199[b]
8151	.182[b]	/ .186[b]

Cold SBR Oil Masterbatch

Ameripol 1705	.2035[c]	/ .2095[c]
1707, 1708	.191[c]	/ .197[c]
1710, 1712	.1885[c]	/ .1945[c]
4700	.175[c]	/ .181[c]
4701	.1725[c]	/ .1785[c]
ASCR 1703	.206[c]	/ .212[c]
1708	.191[c]	/ .197[c]
1712	.1885[c]	/ .1945[c]
1713	.175[c]	/ .181[c]
Carbomix 3750	.182[c]	/ .188[c]
3752	.1845[c]	/ .1905[c]
3754	.177[c]	/ .183[c]
Copo 1712	.1885[c]	/ .1945[c]
1773	.206[c]	/ .212[c]
1778	.191[c]	/ .197[c]
3900	.231[c]	/ .237[c]
FR-S 1703	.206[c]	/ .212[c]
1710	.1885[c]	/ .1945[c]
1712	.1885[c]	/ .1945[c]
123	.196[c]	/ .202[c]
154, 155	.1885[c]	/ .1945[c]
173	.206[c]	/ .212[c]
178	.191[c]	/ .197[c]
Gentro 1712		.1885
Philprene 1703	.206[b]	/ .212[b]
1708	.191[b]	/ .197[b]
1712	.1885[b]	/ .1945[b]
Plioflex 1703, 1773	.206[c]	/ .212[c]
1710C, 1712C	.1885[c]	/ .1945[c]
1713	.175[c]	/ .181[c]
1714C	.1725[c]	/ .1785[c]
1773	.206[c]	/ .212[c]
1778	.191[c]	/ .197[c]
Polysar Krynol 651		.1885[c]
652		.191[c]
S-1703		.195[a]
-1707		.18[a]
-1709, -1712		.1775[a]
-7701		.185[a]
Synpol 1703	.206[b]	/ .212[b]
1707, 1708	.191[b]	/ .197[b]
1711	.19[b]	/ .196[b]
1712	.1885[b]	/ .1945[b]
8200	.191[b]	/ .197[b]
8201	.175[b]	/ .181[b]

Hot SBR Latices

FR-S 2000, 2001	.2725[c]	/ .3425[c]
2002	.35[c]	/ .36[c]
2003, 2004	.305[c]	/ .36[c]
2006	.29[c]	/ .382[c]
Naugatex 2000, 2001	.2775[a]	/ .3575[a]
2002	.30[a]	/ .37[a]
2006	.29[a]	/ .42[a]
Pliolite Latex 2000, 2001		.2825[c]
2076		.295[c]
Polysar Latex II		.29[c]
IV		.2775
S-2000, 2006		.26[a]

(Continued on page 934)

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[a] Freight extra.
[b] Minimum freight allowed.
[c] Freight prepaid.
* Prices are per pound carload of tank-car dry weight unless otherwise specified.
† BR—Butadiene rubber.
‡ SBR—Styrene-butadiene rubber.

Compounding Ingredients*

Abrasives

Pumicestone, powdered	lb.	$0.0363 /	$0.065
Rottenstone, domestic	lb.	.03 /	.04
Shelblast	ton	80.00 /	165.00
Walnut Shell Grits	ton	50.00 /	160.00

Accelerators

A-1 (Thiocarbanilide)	ton	.50 /	.57
A-32	ton	.66 /	.80
A-100	lb.	.52 /	.66
Accelerator 49	lb.	.59 /	.60
52	lb.	1.14	
57, 62, 67, 77	lb.	1.04	
66	lb.	4.25	
89	lb.	1.20	
108	lb.	.92 /	.97
552	lb.	2.25	
808	lb.	.66 /	.68
833	lb.	1.17 /	1.19
Altax	lb.	.54 /	.56
Arazate	lb.	2.25 /	2.30
Beutene	lb.	.66 /	.71
Bismate	lb.	3.00	
B-J-F	lb.	.27 /	.32
Butasan	lb.	1.04	
Butazate	lb.	1.04 /	1.09
Butyl Accelerator Eight	lb.	1.35	
Namate	lb.	.45 /	.50
Zimate	lb.	1.04	
Ziram	lb.	.89 /	1.04
Captax	lb.	.44 /	.46
Conac S	lb.	.76 /	.78
C-P-B	lb.	1.95 /	2.00
Cumate	lb.	1.45	
Cydac	lb.	.76 /	.78
Cyuram DS, powder	lb.	1.14	
Pellets	lb.	1.14	
MS, powder	lb.	1.14	
Pellets	lb.	1.14	
Cyzate B, E	lb.	.85 /	.89
Dibs	lb.	.85	
Dipac	lb.	.85	
DOTG (diorthotolylguanidine)			
Cyanamid	lb.	.69 /	.70
Du Pont	lb.	.69 /	.70
DPG (diphenylguanidine)			
Cyanamid	lb.	.49 /	.50
Monsanto	lb.	.52 /	.58
El-Sixty	lb.	.62 /	.64
Ethasan	lb.	1.04	
Ethazate	lb.	1.04 /	1.09
50-D	lb.	.87 /	.92
Ethyl Seleram	lb.	3.00	
Thiurad	lb.	1.04	
Thiuram	lb.	1.04	
Tuads	lb.	1.04	
Tuex	lb.	1.04 /	1.09
Zimate	lb.	1.04	
Ziram	lb.	.89 /	1.04
Ethylac #650	lb.	.93 /	.95
Guantal	lb.	.60 /	.67
Hepteen	lb.	.44 /	.50
Base	lb.	1.85 /	1.90
Ledate	lb.	1.04	
MBT (2-mercaptobenzothiazole)			
American Cyanamid	lb.	.44 /	.46
Du Pont	lb.	.44 /	.46
Naugatuck	lb.	.44 /	.49
-XXX, Cyanamid	lb.	.55 /	.57
MBTS (mercaptobenzothiazyl disulfide)			
Cyanamid	lb.	.54 /	.56
Du Pont	lb.	.54 /	.56
Naugatuck	lb.	.54 /	.59
-W Cyanamid	lb.	.59 /	.61
Merac #225	lb.	.75 /	1.05
Mertax	lb.	.55 /	.57
Methasan	lb.	1.04	
Methazate	lb.	1.04 /	1.09
Methyl Thiuram	lb.	1.14	
Tuads	lb.	1.14	
Zimate	lb.	1.04	
Monex	lb.	1.14 /	1.19
Mono-Thiurad	lb.	1.14	
2-MT (2-mercaptothiazoline)			
Cyanamid	lb.	.88 /	.90
Du Pont	lb.	1.00	
NA-22	lb.	1.05	
NOBS No. 1	lb.	.76 /	.78
Special	lb.	.80 /	.82
O-X-A-F	lb.	.55 /	.60
Pennac SDB	lb.	.45 /	.48
Pentex	lb.	1.24 /	1.29
Flour	lb.	.30 /	.35
Permalux	lb.	2.25	
Phenex	lb.	.52 /	.59
Pip-Pip		2.07	
Polyac Pellets	lb.	1.85	
R-2 Crystals	lb.	4.35	
Rotax	lb.	.55 /	.57
RZ-50, -50B	lb.	1.00	
S.A. 52	lb.	1.14	
57, 62, 67, 77	lb.	1.04	
66	lb.	3.00	
Santocure	lb.	.76 /	.78
NS	lb.	.80 /	.82
Selenacs	lb.	3.00	
SPDX-GH	lb.	.69 /	.74
GL	lb.	1.20 /	1.34
Sulfads	lb.	1.98	
Tellurac	lb.	1.30 /	1.55
Tepidone	lb.	.45	
Tetrone A	lb.	$1.98	
Thiates	lb.	.88 /	$1.25
Thiofide	lb.	.54 /	.56
S	lb.	.64 /	.66
Thionex	lb.	1.14	
Thiotax	lb.	.44	.46
Thiurad	lb.	1.14	
Thiuram E	lb.	1.04	
M	lb.	1.14	
Trimene	lb.	.56 /	.62
Base	lb.	1.03 /	1.10
Tuex	lb.	1.14	
Ultex	lb.	1.00 /	1.10
Unads	lb.	1.14	
Ureka Base	lb.	.66 /	.73
Vulcacure NB	lb.	.45	
NS	lb.	.75 /	1.05
T.M.D.	lb.	1.14	
ZB, ZE, ZM	lb.	.85 /	.89
Z-B-X	lb.	2.45 /	2.50
Zenite	lb.	.54 /	.56
A	lb.	.69 /	.71
AM	lb.	.76 /	.78
Special	lb.	.55 /	.57
Zetax	lb.	.51 /	.53
Zimate	lb.	1.04	
ZMBT	lb.	.55 /	.57

Accelerator-Activators, Inorganic

Lime, hydrated	ton	21.96	
Litharge, comml.	lb.	.1425 /	.1575
Eagle, sublimed	lb.	.1585	
National Lead, sublimed	lb.	.1585	
Red lead, comml.	lb.	.185 /	.195
Eagle	lb.	.1625	
National Lead	lb.	.1625 /	.1645
PRD-90	lb.	.38 /	.50
White lead, carbonate	lb.	.19 /	.20
Eagle	lb.	.17 /	.18
National Lead	lb.	.18 /	.19
Silicate	lb.	.1725 /	.1825
Eagle	lb.	.1475 /	.22
National Lead	lb.	.165 /	.175
Zinc oxide, comml.†	lb.	.145 /	.155

Accelerator-Activators, Organic

Aktone	lb.	.2125 /	.2325
Barak	lb.	.65	
Capital 170	lb.	.20 /	.25
171	lb.	.1425 /	.1925
225, 258, 710	lb.	.14 /	.19
261	lb.	.155 /	.18
262	lb.	.16 /	.185
263	lb.	.1775 /	.2025
270	lb.	.1175 /	.1425
Curade	lb.	.57 /	.59
D-B-A	lb.	1.95	
Emery 600	lb.	.1425 /	.1925
G-M-F	lb.	2.60 /	2.65
PDD-70	lb.	2.70 /	3.00
PGD-25	lb.	1.25 /	1.50
Groco 30	lb.	.1425 /	.1925
Guantal	lb.	.62 /	.64
Hyfac 410	lb.	.1475 /	.1725
430	lb.	.18 /	.205
431	lb.	.2025 /	.2275
Hystrene S-97	lb.	.1863 /	.2125
T-45	lb.	.1638 /	.19
T-70	lb.	.1738 /	.20
Industrene B	lb.	.1263 /	.1525
R	lb.	.1138 /	.14
158	lb.	.1313 /	.1575
254	lb.	.1413 /	.1675
262	lb.	.1513 /	.1775
Laurex	lb.	.34 /	.38
MODX	lb.	.295 /	.345
NA-22	lb.	1.05	
PND-70	lb.	1.35 /	1.60
Oleic acid, comml.	lb.	.185 /	.225
Emersol 210 Elaine	lb.	.1425 /	.1925
Groco 2, 4, 8, 18	lb.	.1425 /	.1925
Welcoline	lb.	.21 /	.42
Plastone	lb.	.27 /	.30
Polyac	lb.	1.85	
Ridacto	lb.	.25 /	.26
Seedine	lb.	.1485 /	.1703
Stearex Beads	lb.	.1488 /	.1588
Stearic acid			
Emersol 120	lb.	.1625 /	.1875
150	lb.	.19 /	.215
Hydrofoil 51	lb.	.09	
Hydrogenated, rubber grd.			
Groco 56	lb.	.1225 /	.1475
Rufat 75	lb.	.1062 /	.1325
Single pressed, comml.	lb.	.1475 /	.1675
Emersol 110	lb.	.1575 /	.1825
Groco 53	lb.	.1575 /	.1825
Wilmar 253	lb.	.1525 /	.1775
Double pressed, comml.	lb.	.1525 /	.1725
Groco 54	lb.	.1625 /	.1875
Wilmar 254	lb.	.1575 /	.1825
Triple pressed, comml.	lb.	.175 /	.195
Groco 55	lb.	.18 /	.205
Wilmar 255	lb.	.1875 /	.2075
Sterene 60-R	lb.	.09 /	.1075
Tonox	lb.	.515 /	.605
Vimbra	lb.	.32 /	.385
Vulklor	lb.	.88 /	1.08
Wilmar 110	lb.	.17 /	.22
434	lb.	.1425 /	.1925
Zinc stearate, comml.	lb.	.39 /	.44

Antioxidants

AgeRite Alba	lb.	$2.40 /	$2.50
Gel	lb.	.70 /	.72
H. P.	lb.	.79	.80
Hipar	lb.	1.05	1.07
Powder	lb.	.57 /	.59
Resin	lb.	.88 /	.90
D	lb.	.57 /	.59
Spar	lb.	.57	.59
Stalite	lb.	.57	.59
S	lb.	.57	.59
Superlite	lb.	.57	.59
White	lb.	1.50 /	1.60
Akroflex C	lb.	.85 /	.87
CD	lb.	.79 /	.81
Albasan	lb.	.69	.73
Alcogard 354 Powder	lb.	1.50 /	1.52
Allied AA 1144	lb.	.23 /	.24
AA-1177	lb.	.155	.165
Aminox	lb.	.57	.62
Antioxidant 425	lb.	2.47 /	2.50
2246	lb.	1.50 /	1.53
Antisol	lb.	.23 /	.24
Antisun	lb.	.15 /	.51
Antox	lb.	.59 /	.61
Aranox	lb.	3.25 /	3.30
Betanox Special	lb.	.91 /	.96
B-L-E, -25	lb.	.57 /	.62
Burgess Antisun Wax	lb.	.185	
B-X-A	lb.	.55 /	.60
CAO-1	lb.	.37 /	.86
-5	lb.	1.49 /	1.63
Copper Inhibiter X-872-L.	lb.	2.01	
D-B-P-C	lb.	.91 /	1.16
Deenax	lb.	.95	
Flectol H	lb.	.57 /	.59
Flexamine	lb.	.79 /	.84
Heliozone	lb.	.31	.32
Ionol	lb.	.91	1.65
Microflake	lb.	.20 /	.24
Naugawhite	lb.	.57 /	.62
NBC	lb.	1.67	
Neozone A	lb.	.64 /	.66
C	lb.	.86 /	.88
D, Special	lb.	.57 /	.59
Nevastain A	lb.	.51 /	.61
B	lb.	.51 /	.70
Nonox CI	lb.	1.50 /	1.67
WSL	lb.	1.50 /	1.60
WSP	lb.	1.47 /	1.60
Octamine	lb.	.57 /	.62
PDA-10	lb.	.46 /	.48
Pennox A, C, D	lb.	.57 /	.59
B	lb.	.67 /	.69
Perflectol	lb.	.61 /	.68
Permalux	lb.	2.25	
Polygard	lb.	.57 /	.62
Polylite	lb.	.55 /	.60
Protector	lb.	.26 /	.31
Rio Resin	lb.	.60 /	.62
Santoflex 35	lb.	.72 /	.79
75	lb.	1.01 /	1.03
AW	lb.	.71 /	.78
B	lb.	.52 /	.59
BX	lb.	.63 /	.70
DD	lb.	.57 /	.59
Santovar A	lb.	1.55 /	1.57
Santowhite Crystals, Powder	lb.	1.55 /	1.62
L	lb.	.57 /	.59
MK	lb.	1.25 /	1.32
Stabilite	lb.	.55 /	.59
Alba	lb.	.72 /	.79
L	lb.	.60 /	.64
White	lb.	.52 /	.60
Powder	lb.	.41 /	.47
Styphen I	lb.	.51 /	.55
Sunolite #100	lb.	.21 /	.23
#127	lb.	.17 /	.19
Sunproof-713	lb.	.26 /	.31
Improved	lb.	.25 /	.30
Jr.	lb.	.22 /	.27
Tenamene 3	lb.	.91 /	1.05
Thermoflex A	lb.	1.05 /	1.07
Tonox	lb.	.54 /	.59
Tysonite	lb.	.24 /	.2475
Velvapex 51-250	lb.	.40	
V-G-B	lb.	.75 /	.80
Wing-Stay S, T	lb.	.55 /	.67
100	lb.	1.00 /	1.08
Zalba	lb.	1.10	
Zenite	lb.	.52 /	.54

Antiozonants

Eastozone 30, 31	lb.	1.05 /	1.09
Flexone 6-H	lb.	1.25	
Nonox ZA	lb.	1.99 /	2.00
Tenamene 30, 31	lb.	1.24 /	1.28
UOP 88, 288	lb.	1.05 /	1.07

Antiseptics

Copper naphthenate, 6-8%	lb.	.245	
Pentachlorophenol	lb.	.22 /	.30
Resorcinol, technical	lb.	.775 /	.785
Zinc naphthenate, 8-10%	lb.	.245 /	.30

Blowing Agents

Ammonium bicarbonate	lb.	.07 /	.09
Carbonate	lb.	.16	
Blowing Agent CP 1475	lb.	.32 /	.35

* Prices, in general, are f.o.b. works. Range indicates grade or quantity variations. No guarantee of these prices is made. Spot prices should be obtained from individual suppliers.

† For trade names, see Color—White, Zinc Oxides.

Celogen	lb.	$1.95	$2.00
50 C	lb.	1.01	1.07
Kempore R-125	lb.	1.92	
Opex 40	lb.	.72	
PL-80	lb.	1.44	
Sodium bicarbonate	100 lbs.	2.55	3.85
Carbonate, tech.	100 lbs.	1.35	5.52
Sponge Paste	lb.	.20	
Unicel ND	lb.	.72	
NDX	lb.	1.44	
S	lb.	.20	
Vulcacel BN	lb.	1.36	1.51
BMC	lb.	.68	.79

Bonding Agents

Braze	gal.	6.00	9.00
Cover cement	gal.	2.50	4.00
Chemlok 201, 203	gal.	5.00	7.50
220	gal.	9.25	12.00
401	gal.	11.70	14.40
602	gal.	25.00	26.00
607	gal.	18.00	
614	lb.	4.35	4.75
Flocking Adhesive RFA17, RFA22, RFA25	lb.	.50	
G-E Silicone Paste SS-15	lb.	4.52	5.10
SS-64	lb.	3.65	6.75
-67 Primer	lb.	7.50	12.50
Gen-Tac Latex	lb.	.70	.805
Hylene M	gal.	3.50	3.75
M-50	gal.	1.90	2.15
Kalabond Adhesive	gal.	6.50	16.00
Tie Cement	gal.	2.00	5.60
Thixons	gal.	1.48	12.00
Ty Ply, BN, Q, S, UP, 364	gal.	6.75	8.00
RC	gal.	3.75	5.00

Brake Lining Saturants

BRT 3	lb.	.018	.0265
Resinex L-S	lb.	.0225	.03

Carbon Blacks‡

Conductive Channel—CC

Continental R-40	lb.	.26	.35
Kosmos/Dixie BB	lb.	.23	.30
Voltex	lb.	.18	.315

Easy Processing Channel—EPC

Collocarb EPC	lb.	.059	.099
Continental AA	lb.	.0775	.155
Kosmobile 77/Dixiedensed 77	lb.	.074	.1225
Micronex W-6	lb.	.0725	.155
Spheron #9	lb.	.0775	.155
Texas E	lb.	.0775	.145
Witco #12	lb.	.0775	.155
Wyex EPC	lb.	.0725	.155

Hard Processing Channel—HPC

HX HPC	lb.	.074	.1225
Kosmobile S/Dixiedensed S	lb.	.074	.1225
Micronex Mk. II	lb.	.0775	.145
Witco #6	lb.	.074	.1225

Medium Processing Channel—MPC

Arrow MPC	lb.	.0725	.155
Continental A	lb.	.0775	.155
Kosmobile S-66/Dixiedensed S-66	lb.	.0775	.145
Micronex Standard	lb.	.0725	.155
Spheron #6	lb.	.0775	.155
Texas M	lb.	.0775	.145
Witco #1	lb.	.0775	.155

Conductive Furnace—CF

Aromex CF	lb.	.0875	.155
Continex CF	lb.	.11	.17
Vulcan C	lb.	.110	.185
SC	lb.	.18	.255
XC-72	lb.	.25	.34

Fast Extruding Furnace—FEF

Arovel FEF	lb.	.0625	.135
Continex FEF	lb.	.0675	.135
Kosmos 50/Dixie 50	lb.	.06	.10
Philblack A	lb.	.0675	.135
Statex M	lb.	.0625	.135
Sterling SO	lb.	.0675	.135

Fine Furnace—FF

Statex B	lb.	.0675	.14
Sterling 99	lb.	.0725	.14

High Abrasion Furnace—HAF

Aromex HAF	lb.	.0725	.145
Continex HAF	lb.	.0775	.145
Kosmos 60/Dixie 60	lb.	.079	.1175
Philblack O	lb.	.0775	.145
Statex R	lb.	.0725	.145
Vulcan #3	lb.	.0775	.145

Intermediate Super Abrasion Furnace—ISAF

Aromex ISAF	lb.	.0875	.16
Continex ISAF	lb.	.0925	.16
Kosmos 70/Dixie 70	lb.	.10	.045
Philblack I	lb.	.0925	.16
Statex 125	lb.	.0875	.16
Vulcan 6	lb.	.0925	.16

General-Purpose Furnace—GPF

Arogen GPF	lb.	.055	.1275
Continex GPF	lb.	.06	.1275
Statex G	lb.	.055	.1275
Sterling V	lb.	$0.06	$0.1275
Non-staining	lb.	.06	.1275

High Modulus Furnace—HMF

Collocarb HMF	lb.	.045	.085
Continex HMF	lb.	.0625	.13
Kosmos 40/Dixie 40	lb.	.055	.095
Modulex HMF	lb.	.0575	.13
Statex 93	lb.	.0575	.13
Sterling L, LL	lb.	.0625	.13

Semi-Reinforcing Furnace—SRF

Collocarb SRF	lb.	.042	.082
Continex SRF	lb.	.0575	.125
Essex SRF	lb.	.0525	.125
Furnex	lb.	.0525	.125
Gastex	lb.	.0625	.135
Kosmos 20/Dixie 20	lb.	.045	.085
Pelletex, NS	lb.	.0575	.125
Sterling NS, S	lb.	.0575	.125
R	lb.	.0625	.135

Super Abrasion Furnace—SAF

Philblack E	lb.	.115	.19
Statex 160	lb.	.11	.19
Vulcan 9	lb.	.115	.19

Fine Thermal—FT

P-33	lb.	.0575	
Sterling FT	lb.	.0575	

Medium Thermal—MT

Sterling MT	lb.	.04	
Non-staining	lb.	.05	
Thermax	lb.	.04	
Stainless	lb.	.05	

Colors

Black

Iron oxides, comml.	lb.	.1235	.135
BK—Lansco	lb.	.1275	.13
Williams	lb.	.145	
Lansco synthetic	lb.	.10	
Mapico pure synthetic	lb.	.1475	.15
Lampblack, comml.	lb.	.16	.45
Superjet	lb.	.085	.12
Permanent Blue	lb.	.80	1.05
Stan-Tone	lb.	.45	1.20
Vansul masterbatch	lb.	.60	.65
Paste	lb.	.14	.15

Blue

Alkali Blue G, R	lb.	2.38	
C. P. Iran Blues	lb.	.52	.54
Du Pont	lb.	2.55	4.75
Filo	lb.	.28	
Heveatex pastes	lb.	.80	1.45
Lansco ultramarines	lb.	.25	.28
Monsanto Blue 7	lb.	1.55	
11	lb.	3.45	
DPB-283	lb.	1.93	
S-11	lb.	2.05	
Permanent Blue	lb.	.80	1.05
Stan-Tone Violet Blue			
D-4000	lb.	3.45	
4001	lb.	3.00	
4002	lb.	.90	
4900	lb.	1.97	2.15
Vansul masterbatch	lb.	.90	2.70

Brown

Filo	lb.	.13	
Iron oxides, comml.	lb.	.1425	.145
Lansco synthetic	lb.	.125	
Mapico Brown	lb.	.1575	.16
Sienna, burnt, comml.	lb.	.0425	.155
Williams	lb.	.115	.1775
Raw, comml.	lb.	.045	.1325
Williams	lb.	.08	.1725
Umber, burnt, comml.	lb.	.06	.07
Williams	lb.	.0725	.085
Raw, comml.	lb.	.0625	.07
Williams	lb.	.07	.0825
Williams, pure brown	lb.	.155	
Vandyke	lb.	.12	
Mapico Tan	lb.	.2325	.235
Metallic brown pure synthetic	lb.	.05	.06
Vansul masterbatch	lb.	2.10	2.20

Green

Chrome	lb.	.19	.50
Green	lb.	.80	2.40
Oxide	lb.	.3925	1.10
Cyanamid	lb.	.42	.44
Green G	lb.	3.00	
Lincoln Green	lb.	5.30	6.60
G-4099-6099	lb.	.4525	
GH-9869	lb.	1.10	1.25
9976	lb.	1.20	1.35
Du Pont	lb.	2.05	2.80
Filo	lb.	.40	
Heveatex pastes	lb.	.95	1.85
Lansco Toner	lb.	1.35	
Monsanto Green 3	lb.	2.75	
14	lb.	1.45	
17	lb.	3.95	
71205	lb.	1.35	
DGP	lb.	2.03	
S-17	lb.	2.25	
Stan-Tone			
D-5000	lb.	3.95	
5001	lb.	.82	
Stan-Tone D-5400	lb.	$1.45	
Vansul masterbatch	lb.	2.00	$2.60

Orange

Cyanamid Permatons	lb.	1.50	1.56
Du Pont	lb.	2.25	
Monsanto Orange 68187	lb.	2.90	
Stan-Tone			
Light orange 70 PCO3	lb.	2.48	2.76
D-7003	lb.	3.97	4.17
Orange 70 PCO4	lb.	2.80	3.08
D-7004	lb.	4.23	4.43
D-7104	lb.	1.85	2.05
Vansul masterbatch	lb.	2.00	2.60

Red

Antimony trisulfide	lb.	.285	.315
R. M. P. No. 3	lb.	.72	
Sulfur Free	lb.	.78	
Brilliant Toning Red	lb.	1.95	
Cadmium red lithopones	lb.	2.21	3.77
Cadmolith	lb.	1.72	2.20
Cyanamid	lb.	.93	1.90
Naphthol Red, Scarlet	lb.	2.95	3.80
Du Pont	lb.	2.00	2.05
Filo	lb.	.11	
Indian Red	lb.	.1275	
Iron oxide, comml.	lb.	.06	.13
Lansco synthetic	lb.	.1175	
Mapico pure synthetic	lb.	.1425	.145
Recco	lb.	.12	
Williams Red	lb.	.13	.1525
Monsanto Maroon 113	lb.	1.50	
61148	lb.	1.75	
Red 7	lb.	1.55	
41	lb.	4.40	
3501	lb.	1.15	
4004	lb.	1.50	
69191	lb.	3.38	
Autumn	lb.	1.10	
PRP-285	lb.	1.27	
S-44	lb.	1.28	
Rub-Er-Red	lb.	.0975	
Stan-Tone			
70 PCO5	lb.	3.00	3.28
D-2000	lb.	1.25	
2110, 2120, 2121	lb.	.98	
2200	lb.	1.47	
2500	lb.	1.90	
2600	lb.	4.60	
2601	lb.	1.50	
2700		1.75	
2800	lb.	1.90	
Light Red D-7005	lb.	4.68	4.88
7105	lb.	1.97	2.17
Red 70 PCO6	lb.	3.35	3.63
D-7006	lb.	4.89	5.09
D-7106	lb.	2.20	2.40
Vansul masterbatch	lb.	.95	3.30
Venetian	lb.	.04	.0675

White

Antimony oxide	lb.	.27	.285
Burgess Iceberg	ton	50.00	80.00
Cryptone BT	lb.	.10	.11
Permolith lithopone	lb.	.08	.087
Titanium pigments			
Horse Head Anatase	lb.	.255	.27
Rutile	lb.	.275	.29
Rayox LW	lb.	.195	.205
R-110	lb.	.215	.225
Ti-Cal	lb.	.075	.0825
Ti-Pure	lb.	.195	.225
Titanox A, AA, A-168	lb.	.255	.265
C-50	lb.	.1438	.1488
RA, -10, -50	lb.	.275	.285
RC	lb.	.0963	.1013
-HT, -HTX	lb.	.0963	.0988
Rutile	lb.	.205	.29
Unitane	lb.	.255	.29
Zopaque Anatase	lb.	.245	.27
Zinc oxide, comml.	lb.	.145	.1825
Azo ZZZ-11, -44, -55	lb.	.145	.155
20% leaded	lb.	.1505	.1705
35% leaded	lb.	.1513	.1613
50% leaded	lb.	.1558	.0638
Eagle AAA, lead free	lb.	.145	.155
5% leaded	lb.	.145	.155
35% leaded	lb.	.1513	.1613
50% leaded	lb.	.1538	.1638
Florence Green Seal	lb.	.1625	.1725
Red Seal	lb.	.1575	.1675
White Seal	lb.	.1675	.1775
Horsehead XX-4, -78	lb.	.145	.155
Kadox-15, -17, -72, -515	lb.	.145	.155
-25	lb.	.15	.16
Lehigh, 35% leaded	lb.	.1513	.1613
50% leaded	lb.	.1538	.1638
Protox-166, -167	lb.	.145	.155
St. Joe, lead free	lb.	.145	.175
Zinc sulfide, comml.	lb.	.253	.263
Cryptone ZS	lb.	.253	.263

Yellow

Cadmium yellow lithopones	lb.	1.12	1.15
Cadmolith	lb.	1.12	1.20
Cyanamid Hansa Yellow	lb.	2.20	
Du Pont	lb.	2.25	
Filo	lb.	.10	
Iron oxide, comml.	lb.	.0525	.1175
Lansco synthetic	lb.	.1075	
Mapico pure synthetic	lb.	.12	.1275
Williams	lb.	.115	.1225
Monsanto Yellow 14	lb.	1.91	
10010	lb.	1.91	
BYP-282	lb.	1.21	
GA	lb.	2.45	
S-10010	lb.	1.17	

‡ At the request of the suppliers, the lowest prices shown for carbon blacks are for carloads in bags. Prices for hopper carloads are lower.

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Established Eastern Manufacturer of Chemicals and Elastomers has several openings. BS or MS in Chemistry or Chemical Engineering required. Experience with elastomers, paints, or plastics desirable. Replies held confidential.

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Young man with two or three years' experience compounding for molded rubber goods. Permanent position with opportunity for advancement medium sized plant located in Central Massachusetts. Salary commensurate with experience. Send résumé. Replies confidential. Address Box No. 2373, care of RUBBER WORLD.

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Heavy experience in cutting & fabricating foam rubber or urethane foam. Liberal fringe benefits, excellent working conditions, progressive firm, North Jersey location. Send detailed résumé & salary requirements to:

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LATEX CHEMIST, RESIDENT NORTHERN NEW JERSEY, 18 years' experience. Dipping compounds, coagulants, also adhesives and resin emulsions. All types of latices. Laboratory development and factory supervision experience. Address Box No. 2369, care of RUBBER WORLD.

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6—NEW FARREL-BIRMINGHAM 14" x 30" TWO-ROLL MILLS. Other Sizes up to 60" HYDRAULIC PRESSES, 325-ton upstroke 28" x 28", 300-ton upstroke 40" x 30". 300-ton upstroke 22" x 35". 250-ton French Oil upstroke 38" x 28". 240-ton upstroke with ten 24" x 56" platens. 150-ton Farrel 24" x 24". 120-ton 3-opening 24" x 18". Hartig 3¼" Plastic Extruder, electrically heated. Adamson 6" Rubber Extruder. New and used Laboratory 6" x 13", 6" x 16", and 8" x 16" Mills and Calenders. Baker-Perkins and Day Heavy-Duty Jacketed Mixers, up to 200 gallons. Hydraulic pumps and accumulators. Ball & Jewell #2 Rotary Cutter and other sizes. Colton 4T Preform Machines, motor driven. Other sizes in Single-Punch and Rotary types. Banbury Mixers, Crushers, Churns, Tubers, Vulcanizers, Bale Cutters, Gas Boilers, etc. SEND FOR SPECIAL BULLETIN. WE BUY SURPLUS MACHINERY. STEIN EQUIPMENT COMPANY. 107—8th STREET, BROOKLYN 15, NEW YORK. STERLING 8-1944.

FOR SALE: OAKES MODEL M14 MIXER. STAINLESS- STEEL head. Excellent condition. Address Box No. 2368, care of RUBBER WORLD.

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Four-roll inverted L 10" x 18" Farrel calender, complete with 25-HP Westinghouse motor and controls. In good working order.

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TWO 22 x 22 x 60
Farrel-Birmingham
HEAVY DUTY MILLS

with Reducers, Motors, and Controls—Individually driven. Floor level installation.

Rebuilt
Installed
Repaired

Complete job done right in your plant. No supervision required. 30 years experience in servicing mills, mixers, calenders, tubers, etc.

Metal spraying jobs welcomed. Used equipment bought and sold.

WRITE — WIRE — PHONE TODAY

New England Engineering Co., Inc.
P.O. Box 465 A, Derby, Conn. REgent 4-1433

Stan-Tone			
D-1100	lb.	$2.55	
1101	lb.	.69	
Lemon 70 PCO1	lb.	1.77	$2.19
D-7001	lb.	2.80	3.00
Medium yellow 70 PCO2	lb.	1.79	2.21
D-7002	lb.	2.98	3.18
Vansul masterbatch	lb.	.95	1.95
Williams Ocher	lb.	.0575	.06

Dusting Agents

Antidust	lb.	.405	.445
Diatomaceous silica	ton	32.00	48.00
Extrud-o-Lube, conc.	gal.	1.33	1.69
Glycerized Liquid Lubricant, concentrated	gal.	1.25	1.63
Latex-Lube GR	lb.	.20	
Pigmented	lb.	.1825	
R-66	lb.	.165	
Liqui-Lube	lb.	.1625	
N. T.	lb.	.1675	
Liquizinc No. 305	lb.	.30	.35
Lubtex	lb.	.25	.30
Mica 160 Biotite	lb.	.065	.0725
Mesh	lb.	.08	.0875
325 Mesh	lb.	.0825	.09
Concord	lb.	.08	.09
Mineralite	ton	45.00	
Pyrax A	ton	14.50	15.00
W. A.	ton	17.00	17.50
Talc, comml.	ton	18.40	38.50
EM	ton	11.00	63.00
LS Silver	ton	29.25	
Nytals	ton	25.00	36.00
Sierra Sagger 7	ton	34.00	
White IR	ton	19.75	
III	ton	20.75	
Vantre	gal.	2.00	

Extenders

BRS 700	lb.	.02	.036
BRT 7	lb.	.035	.036
Cumar Resins	lb.	.065	.17
Dielex B	lb.	.06	
Factice, Amberex	lb.	.29	.36
Brown	lb.	.1425	.263
Neophax	lb.	.157	.268
White	lb.	.144	.285
G. B. Asphaltenes	lb.	.097	.177
Millex, W	lb.	.07	
Mineral Rubbers			
Black Diamond	ton	38.00	40.00
Hard Hydrocarbon	ton	46.50	48.50
Hydrocarbon MR	ton	45.00	55.00
Parmr	ton	21.00	29.00
T-MR Granulated	ton	47.50	50.00
Nuba No. 1, 2	lb.	.0575	.0625
3X	lb.	.0775	.0825
OPD-101	lb.	.26	
Rubber substitute, brown	lb.	.16	.2572
Car-Bel-Ex A	lb.	.14	
Car-Bel-Lite	lb.	.35	
Extender 600	lb.	.1765	
White	lb.	.192	.2103
Stan-Shells	ton	35.00	73.00
Sublac Resin PX-5	lb.	.215	.235
Sundex 53	gal.	.12	
85	gal.	.1725	
Synthetic 100	lb.	.41	
Vistanex	lb.	.35	.475

Fillers, Inert

Agrashell flour	ton	50.00	74.00
Albacar	ton	55.00	75.00
Barytes, floated, white	ton	49.00	70.85
No. 1	ton	55.00	77.50
2	ton	50.00	72.50
Off-color, domestic	ton	25.00	
Sparmite	ton	95.00	117.00
Blanc fixe	ton	100.00	165.00
Burgess HC-75	ton	12.00	30.00
80	ton	14.00	32.00
Iceberg	ton	50.00	80.00
Pigment #20	ton	35.00	60.00
#30	ton	37.00	60.00
WP #1	ton	11.00	16.00
Camel-Carb	ton	14.00	
-Tex	ton	22.00	
-Wite	ton	35.00	
Cary #200	ton	30.00	55.00
Citrus seed meal	lb.	.04	
Oil	lb.	.15	
Clays			
A. F. D. Filler	ton	29.50	36.00
Aiken	ton	14.00	
Albacar	ton	50.00	55.00
Champion	ton	14.50	
Crown	ton	14.00	33.00
Dixie	ton	14.50	
Franklin	ton	13.50	35.25
GK Soft Clay	ton	11.00	
Harwick	ton	21.50	77.00
Hi-White R	ton	14.50	19.50
Hydratex R	ton	28.00	
Kaolloid	ton	10.50	
LGB	ton	17.50	
LGP	ton	20.00	
McNamee	ton	14.50	
RX-43	ton	33.00	
Natka 1200	ton	12.00	35.00
Par	ton	13.00	
Paragon	ton	14.50	19.50
Polyfil	ton	25.00	45.00
Recco	ton	14.00	
Sno-Brite	ton	12.50	
Stan-Clay	ton	28.00	
Stellar-R	ton	50.00	

Note

Suppliers are requested to submit product additions or deletions and price changes promptly as they occur in order that we may make the listing of maximum service to our readers. Comments on the present listing and classifications are invited with a view toward facilitating location of specific items.

Correspondence should be directed to Market Editor, RUBBER WORLD, 630 Third Avenue, New York 17, New York.

Clays (*Cont'd*)			
Suprex	ton	$14.50	$19.50
Swanee	ton	12.50	
Windsor	ton	14.00	30.00
DC Silica	lb.	1.15	1.40
Diatomaceous silica	ton	32.00	48.00
Flocks			
Cotton, dark	lb.	.095	.135
Dyed	lb.	.55	.60
White	lb.	.13	.33
Fabrifil X-24-G	lb.	.135	
X-24-W	lb.	.235	
Filfloc 6000	lb.	.33	
F-40-900	lb.	.135	
HSC #35 Silicone Emulsion	lb.	1.22	2.46
Hydrite	ton	25.00	50.00
Kalite	ton	52.50	67.50
Lithopone, comml.	lb.	.075	.085
Eagle	lb.	.0725	.075
Permolith	lb.	.08	.0875
Sunolith	lb.	.075	.0825
Mica, 160 Biotite	lb.	.065	.0725
Mesh	lb.	.08	.0875
325 Mesh	lb.	.0825	.09
Concord	lb.	.08	.09
Millical	ton	38.00	53.00
Mineralite	ton	40.00	60.00
Non-Fer-Al	ton	35.00	50.00
Ohio Superspray lime	ton	16.50	
Pulverized limestone, Stone-lite	ton	8.25	11.00
Purecal	ton	56.75	71.75
Pyrax A	ton	13.50	
W. A.	ton	16.00	
Sawdust	ton	14.00	35.00
Silversheen Mica	lb.	.08	.09
Stan White	ton	10.50	13.10
Super-White Silica	ton	25.00	46.50
Surfex	ton	37.50	52.50
MM	ton	42.00	57.00
Suspenso	ton	38.00	53.00
Ti-Cal	lb.	.0675	
Valron Estersil	lb.	2.00	2.25
Walnut shell flours	ton	50.00	84.00
Whiting, limestone			
Atomite	ton	32.50	35.00
Calcite	ton	23.00	
Calwhite	ton	20.00	27.00
-T	ton	23.00	
Duramite	ton	20.00	
Gamaco	ton	32.50	40.00
Keystone	ton	20.00	22.00
Laminar	ton	30.00	
No. 10 White	ton	11.00	16.50
Omya	ton	30.00	
BSH	ton	45.00	
Paxinosa	ton	14.50	22.50
Snowflake	ton	17.00	18.00
Witco	ton	13.00	
York	ton	9.50	

Finishes

Apex Bright Finish #5200-E	lb.	.25	
Rubber Finish	gal.	2.50	
Black-out	gal.	4.50	8.00
Flocks, Rayon, colored	lb.	.90	1.50
White	lb.	.75	1.25
Also see Flocks, under Fillers, Inert			
Paraflint RG and RGU Synthetic Wax	lb.	.15	.22
Rubber lacquer, clear	gal.	1.00	2.00
Shellacs, Angelo	lb.	.485	.7325
Vac Dry	lb.	.485	.57
Talc (*See Talc, under Dusting Agents*)			
Unidip	lb.	.15	.20
Wax, Bees	lb.	.67	.83
Carnauba	lb.	.57	1.13
Monten	lb.	.27	
Neutral	gal.	.76	1.31
No. 118, colors	gal.	.86	1.41
Van Wax	gal.	1.45	1.50

Latex Compounding Ingredients

Acintol D, DLR	lb.	.0625	.085
FA #1	lb.	.0675	.0925
#2	lb.	.0825	.105
Accelerator 552	lb.	2.25	
Accelerator J-117, -302	lb.	$1.00	$1.15
-144	lb.	.15	.30
-307	lb.	1.10	1.25
-311	lb.	.60	.75
Aerosol, dry types	lb.	.65	.80
Liquid types	lb.	.40	.75
Alcogard 354	lb.	1.40	1.42
Alcogum AK-12	lb.	.12	.14
AN-6	lb.	.055	.06
-10	lb.	.09	.10
-25	lb.	.31	
PA-15	lb.	.16	
Alrosol	lb.	.41	
Amberex solutions	lb.	.1675	.18
Antifoam J-114	lb.	3.25	3.45
P-242	lb.	.24	.35
Antioxidant J-137, -140	lb.	.55	.70
-139, -293	lb.	1.45	1.60
-182	lb.	2.00	2.15
-186	lb.	1.40	1.55
2246	lb.	1.50	1.53
Anti Webbing Agent J-183	lb.	.75	.90
-297	lb.	.27	.40
Aquablak B	lb.	.0975	.1025
G	lb.	.12	.125
K	lb.	.12	.125
M	lb.	.105	.11
Aquarex D	lb.	.81	
G	lb.	.21	
L	lb.	.94	
MDL	lb.	.33	
ME	lb.	.82	
Aquarex NS	lb.	.60	
SMO	lb.	.50	
WAQ	lb.	.22	
Areskap 50	lb.	.30	.38
100, dry	lb.	.60	.72
Aresket 240	lb.	.30	.38
300, dry	lb.	.60	.72
Aresklene 375	lb.	.42	.57
Ben-A-Gels	lb.	.98	1.40
Bentone 18, 18C	lb.	.45	
34	lb.	.60	
Casein	lb.	.22	
Cellosize WP-09, -3, -40, -300	lb.	1.00	1.17
CW-12	lb.	.85	
-37	lb.	.70	
DC Antifoam A Compound	lb.	5.45	6.65
B	lb.	.63	1.10
Emulsion	lb.	2.05	4.00
AF Emulsion	lb.	2.05	2.85
Compound 7	lb.	5.13	6.50
Defoama W-1701	lb.	.125	
Defoamer 115a	lb.	.50	
NDW	lb.	.215	.235
Dispersing Agents			
Blancol	lb.	.1525	.26
N	lb.	.155	.26
Darvan Nos. 1, 2, 3	lb.	.22	.30
Daxad 11, 21, 23, 27	lb.	.08	.30
Dispersaid H7A	lb.	.58	
1159	lb.	.43	
Emulphor ON-870	lb.	.50	.70
Igepal CO-630	lb.	.2875	.47
Igepon T-73	lb.	.285	.495
T-77	lb.	.45	.69
Indulins	lb.	.06	.08
Kreelons	lb.	.132	.155
Laurelton Oil	lb.	.18	
Leonil SA	lb.	.52	.65
Lomar PW	lb.	.18	
Marasperse CB	lb.	.1225	.1425
N	lb.	.095	.105
Modicols	lb.	.17	.58
Nekal BA-75	lb.	.395	.54
BX-76	lb.	.63	.75
Nopco 1287	lb.	.155	.195
Orzan A	lb.	.0325	
S	lb.	.0425	
Pluronics	lb.	.335	.40
Polyfons	lb.	.08	.09
Sorapon SF-78	lb.	.28	.40
Tergitol 7	lb.	.4125	.44
NPX	lb.	.275	.3074
TMN	lb.	.2875	.32
Trenmine W-30	lb.	.15	
W-40	lb.	.60	.75
Triton R-100	lb.	.12	.25
X-100, -102, -114	lb.	.255	.36
Dispersions			
Agebest 1293-22	lb.	1.90	2.00
AgeRite Alba	lb.	3.00	
Powder, Resin D	lb.	.80	
White	lb.	1.80	
Altax	lb.	.75	
Shield Nos. 2, 6	lb.	.08	
3	lb.	.095	
4-35	lb.	.09	
5	lb.	.093	
7-F, 8	lb.	.165	
55	lb.	.18	
Iron Oxide, 60%	lb.	.40	
L.S.W.	lb.	1.50	
No. 305 Liquizinc	lb.	.30	.35
P-33	lb.	.35	
Rotax	lb.	.75	
Sulfur	lb.	.12	.30
No. 2	lb.	.14	.16
Telloy	lb.	3.00	
Tuads, Methyl	lb.	1.14	
Vulcacure NB	lb.	.45	
NS	lb.	.75	1.05
T.M.D.	lb.	1.14	
ZB, ZE, ZM	lb.	.85	.89
Vulcanizing, C group	lb.	.40	1.30
G group	lb.	.45	.90
N group	lb.	.40	1.00

Dispersions (*Cont'd*)

Zetax	lb.	$0.75	
Zimates, Butyl	lb.	1.04	
Ethyl, Methyl	lb.	1.04	
Zinc oxide	lb.	.40	
Emulsions			
AgeRite Stalite	lb.	.75	
Borden Arcco A-25, A-26, 716-30	lb.	.18 /	$0.19
555-40R	lb.	.185 /	.205
620-32B	lb.	.20 /	.21
716-35	lb.	.17 /	.18
1041-21	lb.	.165 /	.175
Habuco Resin Nos. 502, 515, 523	lb.	.195 /	.20
503	lb.	.22 /	.225
504, 526	lb.	.19 /	.195
517	lb.	.175 /	.18
524	lb.	.155 /	.16
Resin A-2	lb.	.16 /	.25
P-370	lb.	.175 /	.25
X-210	lb.	.12 /	.22
Freeze-Stabilizer 322	lb.	.40	
12116C	lb.	.52	
Hyonic PE 250	lb.	.255 /	.295
Igepon T-43	lb.	.145 /	.35
T-51	lb.	.125 /	.285
-73	lb.	.285 /	.495
Ludox	lb.	.1675 /	.195
Marmix	lb.	.41 /	.48
Merac	lb.	.75 /	1.05
Micronex, colloidal	lb.	.06 /	.072
Modical S	lb.	.3084 /	.3284
VD	lb.	.1384 /	.1584
Monsanto Blue 4685 WD	lb.	1.60	
Green 4884 WD	lb.	1.80	
Red 127	lb.	1.25	
OPD 101	lb.	.16 /	.26
Picco Latex Plasticizer A-12	lb.	.069 /	.096
Pliolite Latex 150, 190	lb.	.32 /	.41
170	lb.	.37 /	.46
Polyvinyl methyl ether	lb.	.25 /	.45
Resin V	lb.	.13	
Roelgel 100C	lb.	.46	
Santomerse D	lb.	.44 /	.65
S	lb.	.13 /	.25
Sellogen Gel	lb.	.1275	
Sequestrene AA	lb.	.905 /	.975
ST	lb.	.585 /	.615
30A	lb.	.245 /	.265
Setsit #5	lb.	.75 /	1.05
D #9	lb.	.85 /	1.15
Stablex A	lb.	.80 /	1.10
B, G	lb.	.50 /	.95
K	lb.	.27 /	.35
P	lb.	.35 /	.50
T	lb.	.14 /	.22
Surfactol 13	lb.	.345 /	.36
Vult-Accel E	lb.	.85 /	.92
Webnix	lb.	1.50 /	2.50

Mold Lubricants

A-C Polyethylene	lb.	.30 /	.47
Acintol D	lb.	.0625 /	.085
Alipal CO-433	lb.	.25 /	.45
CO-436	lb.	.22 /	.41
Aquarex Compounds	lb.	.21 /	.94
Carbowax 200, 300, 400	lb.	.22 /	.25
1500	lb.	.225 /	.2825
4000	lb.	.31 /	.32
6000	lb.	.35 /	.36
Castorwax	lb.	.3375 /	.3575
Colite Concentrate	gal.	.90 /	1.15
D-Tak Dip #10	gal.	1.50	
DC Mold Release Fluid	lb.	3.14 /	4.75
200 Fluid	lb.	3.14 /	4.75
Compound 4, 7	lb.	5.13 /	6.50
Emulsion 7	lb.	1.20 /	1.74
8, 35, 35A, 35B, 36	lb.	1.20 /	1.74
ELA	lb.	.82	
FT Wax 200	lb.	.265 /	.42
300	lb.	.295 /	.45
Glycerized Liquid Lubricant, concentrated	gal.	1.25 /	1.63
Igepals	lb.	.2875 /	.74
Igepon AP-78	lb.	.44 /	.68
T-43	lb.	.145 /	.35
-51	lb.	.125 /	.285
-73	lb.	.285 /	.495
L-41 Diethyl Silicone Oil	lb.	3.50	
Lubrex	lb.	.27 /	.32
Lubri-Flo	gal.	10.00 /	12.05
Lustermold	lb.	.41	
Mold Paste	lb.	.25	
Monopole Oil	lb.	.16	
Monten Wax	lb.	.57	
MR-22	gal.	9.95 /	14.95
Para Lube	lb.	.046 /	.048
Paraflint RG and RGU Synthetic Wax	lb.	.15 /	.22
Plaskon 8406, 8407	lb.	.30 /	.37
8416, 8417	lb.	.35 /	.42
8429	lb.	.40 /	.47
Pluronics	lb.	.335 /	.44
Poly-Brite PE-20	lb.	.28 /	.42
600	lb.	.42 /	.58
Poly-Cone 125X	lb.	1.20 /	1.40
1000	lb.	.93 /	1.06
Polyglycol E series	lb.	.29 /	.42
RA-1, -2, -3	gal.	2.25 /	3.00
Rubber Glo	gal.	.94 /	.97
SM-33, -55, -61, -62	lb.	1.22 /	1.76
Soap, Hawkeye	lb.	1.25 /	1.45
Purity	lb.	.155 /	.165
Sodium stearate	lb.	.40	
Stoner's 700 series	gal.	1.20 /	1.25
800 series	gal.	1.26 /	1.70
900 series	gal.	1.55 /	2.55
A Series	gal.	1.80 /	4.50

Ucon 50-HB Series	lb.	$0.25 /	$0.375
Ulco	lb.	.12 /	.23
Vanfre	gal.	1.95 /	3.00

Odorants

Alamasks	lb.	.75 /	6.50
Coumarin	lb.	2.95 /	3.55
Curodex 19	lb.	4.75 /	5.05
188	lb.	5.75	
198	lb.	5.75	
Ethavan	lb.	6.75 /	7.35
Latex Perfume #7	lb.	4.00	
Neutroleum Gamma	lb.	3.60	
Rodo	lb.	4.00 /	5.50
Rubber Perfume #10	lb.	2.60	
Vanillin, Monsanto	lb.	3.00 /	3.15

Plasticizers and Softeners

Acintol DLR	lb.	.0625 /	.085
Adipol 2EH, 10A, XX	lb.	.40 /	.435
BCA	lb.	.45 /	.475
ODY	lb.	.43 /	.465
Admex 710	lb.	.3325 /	.3625
711	lb.	.3325 /	.3825
744	lb.	.3925 /	.3825
Aro Lene #1980	lb.	.10 /	.12
Baker AA Oil	lb.	.195 /	.24
Crystal O Oil	lb.	.21 /	.255
Processed oils	lb.	.215 /	.235
Bardol, 639	lb.	.0275 /	.0375
B	lb.	.055 /	.065
Benzoflex 2-45	lb.	.26 /	.29
9-88	lb.	.27 /	.30
Bondogen	lb.	.555 /	.605
BRC-20	lb.	.022 /	.0245
22	lb.	.026 /	.0285
30	lb.	.0165 /	.025
521	lb.	.023	
BRH 2	lb.	.0341 /	.0351
BRS 700	lb.	.036	
BRT 7	lb.	.035 /	.036
BRV	lb.	.0625 /	.065
Bunarex Liquid	lb.	.0425 /	.0555
Resins	lb.	.065 /	.1225
Bunnatol G, S	lb.	.40 /	.505
Butac	lb.	.125 /	.135
Butyl stearate, comml.	lb.	.255	
B-17	lb.	.21 /	.33
Binney & Smith	lb.	.23 /	.26
Harchem	lb.	.2525 /	.3425
Kessoflex	lb.	.245 /	.275
Ohio-Apex	lb.	.26 /	.29
Butyl stearate—G.P.	lb.	.0125 /	.02
R-100	lb.	.045 /	.0525
TT	lb.	.017 /	.02
Califlux 510, 550	lb.	.0275 /	.0375
G.P.	lb.	.015 /	.0225
R-100	lb.	.0475 /	.0575
T-T	lb.	.019 /	.0295
Capryl alcohol, comml.	lb.	.195 /	.235
Columbian Carbon	lb.	.195 /	.30
Harchem	lb.	.195 /	.30
Chlorowax 40	lb.	.1625 /	.1825
70	lb.	.185 /	.245
-S	lb.	.21 /	.27
Circo light	gal.	.17	
Circosol-2XH	gal.	.185	
Contogums	lb.	.0875 /	.111
Cumar Resins	lb.	.065 /	.17
DBM (dibutyl-m-cresol)			
Darax	lb.	.32 /	.3475
DBP (dibutyl phthalate), comml.	lb.	.26 /	.40
Darex	lb.	.30 /	.33
Eastman	lb.	.26 /	.30
Harflex 140	lb.	.26 /	.40
Harwick Std. Chem. Co.	lb.	.325 /	.385
Hatco	lb.	.30 /	.33
Monsanto	lb.	.26 /	.30
Naugatuck	lb.	.30 /	.33
Ohio-Apex	lb.	.26 /	.30
PX-104	lb.	.26 /	.30
Rubber Corp. of America	lb.	.26 /	.44
Sherwin-Williams	lb.	.30 /	.33
DBS (dibutylsebacate) comml.	lb.	.66 /	.69
Eastman	lb.	.68 /	.71
Harflex 40	lb.	.655 /	.745
Hatco	lb.	.66 /	.685
Monoplex	lb.	.66 /	.675
Naugatuck	lb.	.665 /	.69
PX-404	lb.	.665 /	.685
DCP (dicaprylphthalate), comml.	lb.	.295 /	.325
Harflex 180	lb.	.25 /	.39
Hatco	lb.	.295 /	.325
Monoplex	lb.	.30 /	.315
DDA (didecyladipate)			
Good-rite GP-236	lb.	.40 /	.55
Kessoflex	lb.	.40 /	.435
DDP (didecylphthalate)			
Good-rite GP-266	lb.	.295 /	.45
Hatco	lb.	.305 /	.435
Defoamer X-3	lb.	.355	
DKBA (diisobutyladipate)			
Darex	lb.	.4325 /	.4625
Eastman	lb.	.40 /	.44
Ohio-Apex	lb.	.41 /	.445
DIDA (diisodecyladipate)			
Monsanto	lb.	.40 /	.435
RC	lb.	.40 /	.54
DIDP (diisodecylphthalate)			
Darex	lb.	.32 /	.35
Harflex 110	lb.	.26 /	.40
Monsanto	lb.	.26 /	.30
Ohio-Apex	lb.	.26 /	.30
PX-120	lb.	.26 /	.30
DIDP—RC	lb.	$0.26 /	$0.43
Dielex B	lb.	.06	
Diethylene glycol, comml.	lb.	.1525 /	.1825
Wyandotte	lb.	.15 /	.165
Dinopol IDO	lb.	.285 /	.32
DIOA (diisooctyladipate)			
Harflex 220	lb.	.40 /	.495
Kessoflex	lb.	.40 /	.435
Naugatuck	lb.	.435 /	.465
PX-208	lb.	.40 /	.435
Rubber Corp. of America	lb.	.40 /	.54
DIOP (diisooctylphthalate), comml.	lb.	.305 /	.335
Darex	lb.	.32 /	.35
Eastman	lb.	.25 /	.29
Harflex 120	lb.	.25 /	.39
Hatco	lb.	.305 /	.335
Monsanto	lb.	.25 /	.29
Naugatuck	lb.	.305 /	.335
Ohio-Apex	lb.	.25 /	.29
PX-108	lb.	.26 /	.30
Rubber Corp. of America	lb.	.25 /	.43
Sherwin-Williams	lb.	.32 /	.34
DIOS (diisooctylsebacate), comml.	lb.	.61 /	.64
Rubber Corp. of America	lb.	.5925 /	.70
DIOZ (diisooctylazelate)			
Cabflex	lb.	.48 /	.51
Dipolymer Oil	gal.	.33 /	.38
Dispersing Oil No. 10	lb.	.06 /	.0625
DNODA (di-n-octyl-n-decyl adipate), Monsanto	lb.	.40 /	.435
DOA (dioctyladipate), comml.	lb.	.425 /	.455
Eastman	lb.	.40 /	.43
Good-rite GP-233	lb.	.40 /	.55
Harflex 250	lb.	.40 /	.495
Hatco	lb.	.435 /	.465
Monsanto	lb.	.40 /	.435
Naugatuck	lb.	.435 /	.465
PX-238	lb.	.40 /	.435
Rubber Corp. of America	lb.	.40 /	.54
DOP (dioctylphthalate), comml.	lb.	.305 /	.335
Darex	lb.	.32 /	.35
Eastman	lb.	.28 /	.315
Good-rite GP-261	lb.	.285 /	.44
Harflex 150	lb.	.25 /	.39
Hatco	lb.	.305 /	.335
DOP (comml.)			
Monsanto	lb.	.25 /	.29
Naugatuck	lb.	.305 /	.335
Ohio-Apex	lb.	.25 /	.29
Polycizer 162	lb.	.28 /	.435
PX-138	lb.	.25 /	.29
Rubber Corp. of America	lb.	.25 /	.43
Sherwin-Williams	lb.	.305 /	.335
DPS (dioctylsebacate), comml.	lb.	.61 /	.64
Eastman	lb.	.61 /	.64
Harflex 50	lb.	.5925 /	.6825
Hatco	lb.	.61 /	.635
Monoplex	lb.	.61 /	.635
Naugatuck	lb.	.615 /	.64
PX-438	lb.	.5925 /	.6225
Rubber Corp. of America	lb.	.5925 /	.70
DOZ (di-ethylhexyl azelate)			
Kessoflex	lb.	.46 /	.48
Drapex 3.2	lb.	.40 /	.54
Dutch Boy NL-A10 (DBP)	lb.	.30 /	.33
-A20 (DOP), A30 (DIOP)	lb.	.305 /	.335
-A54	lb.	.295 /	.325
-C20 (DOS)	lb.	.61 /	.63
-F21	lb.	.395 /	.425
-F31	lb.	.44 /	.47
-F41	lb.	.48 /	.51
Dutrex 6	lb.	.025 /	.035
Dymerex Resin	lb.	.135 /	.1475
Elastex 36-R	lb.	.43 /	.4625
37-R	lb.	.70 /	.71
Emulphor EL-719	lb.	.52 /	.73
Endor	lb.	.67	
Ethox	lb.	.43 /	.455
Ethylene glycol, comml.	lb.	.135 /	.165
Wyandotte	lb.	.1325 /	.1425
Flexol 3 GH	lb.	.44 /	.46
3 GO	lb.	.53 /	.55
4 GO	lb.	.325 /	.355
10-A	lb.	.425 /	.455
426	lb.	.27 /	.30
810, 810X, 10-10, 10-10X	lb.	.305 /	.335
TPF, A-26	lb.	.435 /	.465
Flexricin P-4	lb.	.3475 /	.3625
P-6	lb.	.415 /	.43
P-8	lb.	.3475 /	.3625
PG-16	lb.	.335 /	.35
Fortex	lb.	.125 /	.145
Fura-Tone NC 1008	lb.	.28	
1012	lb.	.46	
G. B. Asphaltic Flux	gal.	.097 /	.177
Naphthenic Neutrals	gal.	.125 /	.215
Process oil, light	lb.	.0275 /	.0375
Medium	lb.	.0375 /	.0475
Galex W-100	lb.	.155 /	.18
W-100 D	lb.	.1525 /	.1775
Gilsowax B	lb.	.0975 /	.11
Harchemex	lb.	.24 /	.345
Harflex 300	lb.	.58 /	.675
325	lb.	.4325 /	.52
375	lb.	.7425 /	.83
500	lb.	.315 /	.41
HB-20	lb.	.19 /	.22
-40	lb.	.15 /	.17
Heavy Resin Oil	lb.	.0225 /	.0375
HSC-13	lb.	.25 /	.32
-39	lb.	.22 /	.29
Hycar 1312	lb.	.60	
Kapsol	lb.	.33 /	.355

MACHINERY & SUPPLIES FOR SALE (Cont'd)

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4—Blaw Knox 6' x 40' Horizontal Vulcanizers with quick-opening doors, 250# working pressure, ASME.
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2—Royle #½ Extruders, complete.
1—Banbury Midget Mixer with 2-HP gear motor.
1—Farrel-Birmingham 3-roll Lab Calender, 6" x 12".

Address Box No. 2367, care of RUBBER WORLD.

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FOR SALE: 1—22" x 60" FARREL 3-ROLL CALENDER; 1—18" x 50" Thropp 2-roll mill, MD; 1—32" x 32" hydraulic press, 16" ram; 1—4' x 12' vulcanizer, Q. O. door.

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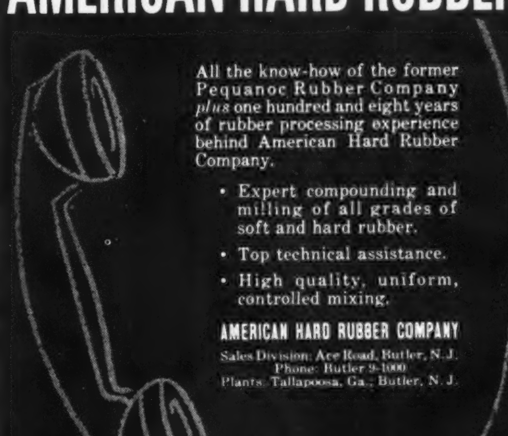

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Sales Division: Ace Road, Butler, N. J.
Phone: Butler 9-1000
Plants: Tallapoosa, Ga.; Butler, N. J.

Kenflex A, L	lb.	$0.26	$0.27
B	lb.	.23	.24
N	lb.	.18	.19
Kessoflex 103	lb.	.405	
105	lb.	.3325	
106	lb.	.38	
107	lb.	.525	
110	lb.	.24	
111	lb.	.28	
KP-23	lb.	.325	.335
-90	lb.	.40	.435
-140	lb.	.46	.485
-201	lb.	.45	.465
-220	lb.	.33	.365
-555	lb.	.59	.60
Kronisol	lb.	.34	.375
Kronitex AA, I, K-3, Mx	lb.	.325	.36
LX-685, -125, -135	lb.	.125	.135
Marvinol plasticizers	lb.	.28	.8825
Methox	lb.	.375	.40
Monoplex S-38	lb.	.215	.24
S-71	lb.	.45	.475
Morflex	lb.	.25	.65
Natac	lb.	.12	.13
Neoprene Peptizer P-12	lb.	1.05	
Nevillac	lb.	.31	.85
Neville R Resins	lb.	.145	.205
Nevinol	lb.	.24	
No. 1-D heavy oil	lb.	.065	
NP-10	lb.	.50	.53
ODA (octyldecyladipate)			
Good-rite GP-235	lb.	.40	.55
Kessoflex	lb.	.40	.435
RC	lb.	.40	.54
ODP (octyldecylphthalate)			
Good-rite GP-265	lb.	.29	.445
Hatco	lb.	.305	.335
Rubber Corp. of America	lb.	.255	.43
Ohopex Q-10	lb.	.265	.305
R-9	lb.	.3525	.3775
Orthonitro benzophenol, comml.	lb.	.13	.15
Palmalene	lb.	.15	
Panaflex BN-1	lb.	.185	.225
Panarez Resins	lb.	.09	.14
Para Flux, regular	gal.	.10	.2125
No. 2016	gal.	.165	.24
2332	gal.	.11	
4205	lb.	.1075	.2125
Para Lube	lb.	.46	.48
Resins	lb.	.04	.045
Paradene Resins	lb.	.07	.08
Paraplex 5-B	lb.	.29	.3475
Al-111	lb.	.32	.3275
G-25	lb.	.76	.77
-40	lb.	.4825	.51
-50	lb.	.39	.4175
-53	lb.	.4325	.46
-60	lb.	.325	.35
-62	lb.	.345	.37
RG-7	lb.	.33	.335
-8	lb.	.505	.5125
-10	lb.	.52	.5275
Pepton 22	lb.	.83	.86
65	lb.	1.23	1.26
65-B	lb.	.83	.86
Philrich 5	gal.	.125	
Picco Resins	lb.	.1275	.22
480 Oilproof Series	lb.	.18	.23
Aromatic Plasticizers	lb.	.05	.065
Liquid Resin D-165 (Y)	lb.	.06	.075
(Z-3)	lb.	.07	.085
(Z-6)	lb.	.08	.095
S. O. S.	gal.	.29	.34
Piccocizers	lb.	.04	.055
Piccolastic Resins	lb.	.16	.25
Piccolyte Resins	lb.	.205	.245
Piccopale Resins	lb.	.12	.135
Piccovars	lb.	.165	.20
Piccovol	lb.	.025	.038
Pictar	gal.	.25	.30
Pigmentar	lb.	.046	.0634
Pigmentaroil	lb.	.046	.0634
Pitch, Burgundy, Sunny South	lb.	.103	.1085
Pitt-Consol 500	lb.	.28	.305
640	lb.	.42	
Plasticizers			
42	lb.	.34	.40
84	lb.	.25	.29
B	lb.	.35	.45
DP-520	lb.	.435	.455
MP	lb.	.035	.0755
MT-511	lb.	.6925	.7425
ODN	lb.	.35	.475
SC	lb.	.38	.55
Plastoflex #3	lb.	.52	.57
#520	lb.	.36	.435
DBE	lb.	.50	.55
MGB	lb.	.29	.37
SP-2	lb.	.43	.48
VS	lb.	.3575	.3975
Plastogen	lb.	.0875	.09
Plastone	lb.	.25	.32
Polycin 470	lb.	.325	.34
Polycizers	lb.	.25	.415
162	lb.	.25	.405
Polymel-C	lb.	.1775	.1875
DX, C-130	lb.	.1375	.1475
D	lb.	.225	.235
D-TAC	lb.	.1975	.215
Poly-Sperse AP-2	lb.	.23	.295
AP-300	lb.	.26	.325
LC-20	lb.	.26	.325
R-100	lb.	.17	.235
PT Pine Tars	lb.	.038	.0554
101 Pine Tar Oil	lb.	.038	.0554
Reogen	lb.	.1425	.145
Resin C pitch	lb.	.0225	.031
Resin R6-3'	lb.	$0.38	$0.40
Resinex 10, 25, 50, 110	lb.	.04	.045
70	lb.	.0325	.0375
85, 100	lb.	.035	.04
115	lb.	.0375	.0425
L-2, L-3, L-4, L-5	lb.	.0225	.03
Rosin Oil, Sunny South	gal.	.58	.76
RPA No. 2	lb.	.85	
3	lb.	.51	
Conc.	lb.	.85	
6	lb.	1.66	
RSN Flux	gal.	.10	.91
Rubber Oil B-5	lb.	.0225	.0355
Rubberol	lb.	.18	.2725
Santicizer 1-H	lb.	.50	.52
8	lb.	.44	.46
9	lb.	.42	.44
140	lb.	.325	.36
141	lb.	.34	.375
160	lb.	.25	.29
409	lb.	.39	
602	lb.	.285	
B-16	lb.	.4475	.4675
E-15	lb.	.51	.54
Santocizer	lb.	.4275	.4575
Sebacic acid, purified, comml.	lb.	.59	.65
Binney & Smith	lb.	.64	.76
C. P.-Binney & Smith	lb.	.72	.84
Harchem	lb.	.655	.815
Sherolatum Petroleum	lb.	.05	.10
Softener #20	gal.	.10	.20
Special Rubber Resin 100	lb.	.1675	.2175
Staflex AX	lb.	.43	
DBES	lb.	.61	.635
Syn-Tac	gal.	.33	.635
Synthol	lb.	.17	.2625
Tetraflex R-122	lb.	.245	.285
Thiokol TP-90B	lb.	.59	
-95	lb.	.65	
Triacetin	lb.	.365	.405
Tributyl phosphate	lb.	.50	.535
Tributyrin	lb.	.69	
Tricresyl phosphate, comml	lb.	.33	.36
Monsanto	lb.	.325	.36
Naugatuck	lb.	.33	.36
PX-917	lb.	.33	.36
Triphenyl phosphate, comml.	lb.	.39	.40
Monsanto	lb.	.415	.435
Turgum S	lb.	.1075	.1175
SB	lb.	.07	.08
Turpol NC 1200	lb.	.61	.70
Tysonite	lb.	.3025	.305
United	gal.	.69	1.20
X-1 Resinous Oil	lb.	.0225	.0325

Reclaiming Oils

Bardol, 639	lb.	.0275	.0375
B	lb.	.055	.065
BRH 2	lb.	.0213	.0351
BRT 3	lb.	.02	.031
4	lb.	.02	.031
7	lb.	.035	.036
BRV	lb.	.0625	.065
Burco-RA	lb.	.053	.0805
BWH-1	lb.	.16	.18
Dipolymer Oil	gal.	.33	.43
Dispersing Oil No. 10	lb.	.06	.0625
G. B. Oils	gal.	.115	.275
Heavy Resin Oil	lb.	.0225	.0375
LX-572	gal.	.27	.32
-759	gal.	.1375	
-777, -809, -859	gal.	.23	.33
-869	gal.	.33	.43
-871	gal.	.34	.44
No. 3186	gal.	.28	.295
Picco 6535	gal.	.25	.30
C-33	gal.	.215	.315
-42	gal.	.23	.33
D-4	gal.	.27	.37
E-5	gal.	.25	.35
Q-Oil	gal.	.286	.36
Pitt-Consol 500	lb.	.28	.305
640	lb.	.42	
PT 101 Pine Tar Oil	lb.	.038	.0554
Reclaiming Oil #3186	gal.	.28	.385
-G	gal.	.25	.365
4039-M	gal.	.3275	.3975
-Y	gal.	.30	.37
RR-10	lb.	.37	
S. R. O.	lb.	.015	.0225
X-1 Resinous Oil	lb.	.0225	.0325

Reinforcers, Other Than Carbon Black

Angelo Shellacs	lb.	.485	.7325
Borden, Chem. Div.			
Arcco 978-42B	lb.	.18	.19
1073-18B	lb.	.135	.145
1294-36B	lb.	.115	.125
1301-12B	lb.	.15	.16
BRC-20	lb.	.0235	.0245
22	lb.	.026	.0285
30	lb.	.0165	.025
521	lb.	.023	
Bunarex Resins	lb.	.065	.1225
Cab-o-sil	lb.	.66	1.45
Calcene CO	ton	105.00	125.00
NC	ton	80.00	100.00
TM	ton	82.50	102.50
Car-Bel-Rez C	lb.	.126	.1451
Clays			
Aiken	ton	14.00	
Buca	ton	45.00	
Burgess Iceberg	ton	50.00	80.00
Icecap K	ton	65.00	90.00
Clays (*Cont'd*)			
Burgess Pigment #20	ton	$35.00	$60.00
#30	ton	37.00	60.00
Catalpo	ton	35.00	
Crown	ton	14.00	33.50
Dixie	ton	14.50	
Franklin	ton	13.50	35.25
L. G. B.	ton	17.50	
McNamee	ton	14.50	
Par	ton	15.00	
Paragon	ton	14.50	33.00
Pigment No. 33	ton	37.00	
Polyfil C	ton	25.00	
Recco	ton	14.00	
Suprex	ton	14.50	33.50
Swanee	ton	12.50	
Whitetex	ton	50.00	
Windsor	ton	14.00	30.00
Witco No. 1	ton	14.00	30.00
No. 2	ton	13.50	30.00
Clearcarb	lb.	.1175	.1255
Cumar Resins	lb.	.065	.17
Darex Resins	lb.	.42	.49
DC Silica	lb.	1.15	1.40
Diatomaceous silica	ton	32.00	48.00
Good-rite 2007	lb.	.36	.38
2057	lb.	.30	.31
Hi-Sil 233	lb.	.0825	.0975
X303	lb.	.40	.45
Hycar 2001	lb.	.55	
2007	lb.	.39	
Indulins	lb.	.06	.08
Kralac A-EP	lb.	.43	.54
Laminar	ton	30.00	
Magnesium carbonate, Marinco CL	lb.	.11	.14
Marbon Resins	lb.	.36	.43
Multifex MM	ton	117.50	137.50
Super	ton	167.50	187.50
Neville Resins			
465	lb.	.075	.08
LX-509	lb.	.33	.35
Nebony	lb.	.045	.05
Paradene	lb.	.07	.08
R	lb.	.145	.205
Para Resins 2457	lb.	.04	.045
Parapol S-Polymers	lb.	.44	
Picco Resins	lb.	.1275	.22
Piccolyte Resins	lb.	.205	.27
Piccoumaron Resins	lb.	.07	.195
Piccovars	lb.	.145	.20
Pliolite NR types	lb.	.98	1.33
S-3	lb.	.42	.49
-6	lb.	.36	.43
B	lb.	.36	.43
E	lb.	.36	.43
Plio-Tuf G85C	lb.	.52	.59
Purecal M	ton	56.75	71.75
SC, T	ton	110.00	125.00
U	ton	120.00	135.00
R-B-H 510	lb.	.15	.22
Resinex	lb.	.0375	.0525
Rubber Resin LM-4	lb.	.28	.35
Silene EF	lb.	.06	.07
L	lb.	.0575	.0675
Silvacons	ton	55.00	85.00
Transphalt	lb.	.0375	.0575
Witcarb P	ton	117.50	153.50
R	ton	127.50	163.50
Regular	ton	60.00	96.00
Zeolex 23	lb.	.055	.065
Zinc oxide, commercial†	lb.	.145	.155

Retarders

Benzoic acid TBAO-2	lb.	.44	
E-S-E-N	lb.	.37	.39
Good-rite Vultrol	lb.	.62	.66
R-17 Resin	lb.	.1075	.36
Retarder ASA	lb.	.57	
J	lb.	.68	.73
PD	lb.	.39	.41
W	lb.	.46	
Retardex	lb.	.47	.50
Thionex	lb.	1.14	
Wiltrol P	lb.	.37	.39

Solvents

Bondogen	lb.	.555	.605
Butyrolactone	lb.	.60	.65
Cosol #1	gal.	.37	.43
#2	gal.	.42	.48
Dichloro Pentanes	lb.	.04	.07
Dipentene DD, Sunny South	gal.	.42	.63
Ethylene dichloride, comml	lb.	.09	.122
Hi-Flash 2-50-W	gal.	.41	
Pale yellow	gal.	.39	
LX-572	gal.	.27	.32
-748	gal.	.16	.23
Methyl-2-pyrrolidone	lb.	.75	.80
Neville Nos. 100, 104	gal.	.52	.60
106	gal.	.38	.46
Nevsolv H, 200	gal.	.19	.29
HF, T, 30	gal.	.24	.34
Penetrell	gal.	.42	.63
Picco Hi-Solv Solvents	gal.	.16	.48
Pine Oil DD, Sunny South	lb.	.15	
Skellysolve-B	gal.	.17	
-C	gal.	.162	
-H	gal.	.148	
-R, -V	gal.	.139	
Stauffer Carbon Disulfide	lb.	.0525	.085
Tetrachloride	lb.	.0825	.475

Tackifiers

Actinol DLR	lb.	.0625	.085
Bardol, 639	lb.	.0275	.0375

Borden, Arcco			
A25, A26, 716-30	lb.	.18	.19
555-40R	lb.	.185	.205
620-32B	lb.	.20	.21
716-35	lb.	.17	.18
1041-21	lb.	.165	.175
BRH 2	lb.	.0213	.0351
Bunarex Resins	lb.	.065	.1225
Chlorowax 70	lb.	.18	.24
Contogums	lb.	.0875	.11
Cumar Resins	lb.	.065	.17
Galex W-100	lb.	.155	.17
W-100D	lb.	.1525	.1625
Indopol H-35	gal.	.65	.84
H-50	gal.	.70	.89
-100	gal.	.85	1.08
-300	gal.	1.00	1.24
-1500	gal.	1.48	
L-10	gal.	.40	.59
-50	gal.	.45	.64
-100	gal.	.55	.74
Kenflex resins	lb.	.18	.27
Koresin	lb.	.90	1.10
Natac	lb.	.12	.13
Nevindene	lb.	.15	.18
Picco Resins	lb.	.1275	.22
Piccolastic Resins	lb.	.1855	.34
Piccolyte Resins	lb.	.185	.25
Piccopale Resins	lb.	.089	.13
Piccoumaron Resins	lb.	.07	.185
R-B-H 510	lb.	.15	.22
Roelflex 1118A	lb.	.39	
Synthetic 100	lb.	.41	
Synthol	lb.	.17	.2625
United	gal.	.69	1.20

Vulcanizing Agents

Dibenzo G-M-F	lb.	2.60	
G-M-F #113, #117	lb.	.90	
Di-Cup	lb.	1.10	
Dodecenyl succinic anhydride	lb.	.75	.76
HMDA-Carbamate	lb.	4.50	4.90
Ko-Blend I, S	lb.	.39	
Litharge (*See Accelerator-Activators, Inorganic*)			
Magnesium oxide	lb.	.2525	.38
Maglite D, K, Y	lb.	.2525	.305
L	lb.	.2975	.3225
M	lb.	.27	.32
Marmag	lb.	.2475	.295
Michigan No. 1782	lb.	.2525	.30
PSD 85	lb.	.37	.50
Red Lead (*See Accelerator-Activators, Inorganic*)			
Sulfasan R	lb.	1.55	1.57
Sulfur flour, comml.	100 lbs.	2.55	3.30
1018	lb.	.12	.1575
Aero	100 lbs.	2.40	7.75
Crystex	lb.	.195	.23
Insoluble 60	lb.	.125	.13
Rubbermakers	100 lbs.	2.65	4.55
Stauffer	lb.	.0265	.054
Telloy	lb.	2.75	
VA-7	lb.	.50	
Vandex	lb.	7.50	
Vultac No. 2	lb.	.47	.74
3	lb.	.51	.78
White lead silicate (*See Accelerator-Activators, Inorganic*)			

Synthetic Rubbers

(Continued from page 922)

Cold SBR Oil-Black Masterbatch

Ameripol 1805	$0.155[c]	$0.161[c]
4750	.1545[c]	.1605[c]
4751	.140[c]	.146[c]
4752	.160[c]	.166[c]
4753	.148[c]	.154[c]
Baytown 1801		.176[b]
Carbomix 3751, 3758	.1545[c]	.1605[c]
3753, 3759	.164[c]	.170[c]
3755	.147[c]	.153[c]
3756	.1576[c]	.1636[c]
3757	.148[c]	.154[c]
Gentro-Jet 9250		.158
9251		.164
9252		.167
9275		.150
OB-102		.1825[a]
-104		.1475[a]
-106		.151[a]
-110		.141[a]
-111		.154[a]
-113		.175[a]
Philprene 1803	.174[b]	.18[b]
1805	.155[b]	.161[b]
6604	.208[b]	.214[b]
6608	.146[b]	.152[b]
6620	.1545[b]	.1605
6661	.182[b]	.188[b]
6682	.148[b]	.154[b]
S-1803		.165[a]
-1804		.175[a]
Synpol 8250	.174[b]	.18[b]
8253	.1584[b]	.1644[b]
8254	.1545[b]	.1605[b]
8266	.1598[b]	.1658[b]

Cold SBR Rosin Masterbatch

Copo 3900	.231[c]	.237[c]

Cold SBR Latex

CL-101		$0.28[a]
Copo 2101	$0.30[c]	.4025[c]
2102, 2105, 2110, 3851	.32[c]	.3725[c]
2108	.30[c]	.3675[c]
2109	.2775[c]	.3450[c]
3852	.2900[c]	.3500[c]
FR-S 2105	.32[c]	.366[c]
Naugatex 2105, 2107	.32[a]	.38[a]
2108	.30[a]	.38[a]
2113	.29[a]	.36[a]
Pliolite Latex 2101		.30[c]
2105, 2107		.32[c]
2108		.30[c]
Polysar Latex 721		.32[c]
S-2101		.26[a]
-2105		.28[a]
-2107		.32[a]
-2108		.29[a]

Urethane Types

Adiprene L, LD-167, -213	1.15	1.65

Rayon and Nylon

(Continued from page 920)

will be made in the replacement passenger tire and truck tire market, reported the company. The continuing acceptance of Tyrex yarn is indicated by the fact that again in 1960 this type will be standard equipment in virtually all new cars.

On August 17, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., announced a price cut of nylon tire cord yarns by 9¢ to 14¢ a pound, or 8% to 11%, in a move that portends heightening competition with rayon products for a major share of the tire cord market. Price cuts for nylon yarns were also announced by The Chemstrand Corp., and by Allied Chemical Corp.

Du Pont's price also is apparently setting the stage for a renewed assault on the original-equipment tire market in Detroit. All past efforts have been unsuccessful. The cut, it appears, will narrow sharply the price differential between nylon and Tyrex tire cord

Du Pont's 840 denier nylon yarn was reduced from $1.20 to $1.06 per pound. The 1680 denier yarn was reduced from $1.12 to $1.03 per pound. The recently introduced 720 denier yarn was decreased from $1.23 to $1.09 per pound. Chemstrand made similar price cuts for these denier yarns.

Allied, the third major supplier of nylon tire yarn, produces about 10% of the tire industry's requirements Allied's nylon, called Golden Caprolan is based on caprolactam.[1] Allied also made the price cuts to coincide with the readjusted prices of other major nylon manufacturers. The new price levels for Allied's various denier nylon yarns follow: 840, $1.06 from old price of $1.20; 2100 and 2500, $1.06 from $1.18; and 3360, 4200, 5000, 5800 $1.05 from $1.17.

Totaled packaged production of rayon and acetate filament yarn during July was 65,000,000 pounds, consisting of 29,800,000 pounds of high tenacity rayon yarn and 35,200,000 pounds of regular-tenacity rayon yarn Filament yarn shipments to domestic consumers during July totaled 62,100,000 pounds, of which 29,200,000 pounds were high-tenacity rayon yarn, and 32,900,000 pounds were regular-tenacity rayon yarn.

Rayon Prices

Tire Fabrics

1100/490/2		$0.625/$0.78
1650/908/2		.685
2200/980/2		.655

Tire Yarns

High-Tenacity		
1100/ 490, 980		.66
1100/ 490		.66
1150/ 490, 980	.59/	.63
1165/ 480	.59/	.65
1230/ 490	.59/	.63
1650/ 720	.55/	.58
1650/ 980	.55/	.58
1875/ 980	.55/	.58
2200/ 960	.54/	.57
2200/ 980	.54/	.57
2200/1466		.64
4400/2934		.60
Super-High Tenacity		
1650/ 720		.60
1900/ 720		.58

Nylon Prices

Tire Yarns

840/140	1.06
1680/280	1.03

[1] See RUBBER WORLD, June, 1959, pp. 463, 490.

News from Abroad

(Continued from page 806)

A proposal by Russia for a long-term rubber contract has been rejected by Indonesia, it is learned. The latter, it seems wishes to supply rubber to Russia only on a yearly basis. The governments of both countries, however, are interested in trading with each other, and a trade delegation from Indonesia is shortly to leave for Moscow to discuss a trade agreement. Russia wants Indonesia's rubber, tea, and coffee, and Indonesia would get machinery in return.

***Rubber Journal & International Plastic* recently reported that a group of American businessmen is studying the possibility of establishing large guayule plantations in western Australia.** The plan is to create units of 10,000 acres each, with a central processing plant capable of handling 10,000,000 pounds annually. Experiments have been going on concerning the use of guayule in Australia since 1941. Similar experiments by the Natural Rubber Research Station of the United States Department of Agriculture at Salinas, Calif., were used for comparison. Five-year-old shrubs from the Australian plantings were sent to Salinas for comparison, and it was found that they were considerably larger than the American grown controls. The defoliated dry weight ran about four times greater for the Australian shrubs. Consequently, although the U. S. shrubs had a higher rubber content, the opinion was that the Australian plantations would yield more rubber than the Salinas plantings.

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